ENVIRONMENT AUDIT REPORT

TECHNOCRATS INSTITUTE OF TECHNOLOGY (EXCELLENCE)

Anand Nagar, Opp. Hataikheda Dam, BHEL,
Bhopal, Madhya Pradesh - 462021

PREPARED BY

EMPIRICAL EXERGY PRIVATE LIMITED
Flat No. 201, OM Apartment, 214 Indrapuri Colony, Bhawarkuan,
Indore – 452 001 (M. P.), India 0731-4948831, 7869327256
Email ID:eempirical18@gmail.com
www.eeplgroups.com

(2021-23)

CONTENTS

ACKNOWLEDGEMENT

We would like to thank the **Technocrats Institute of Technology (Excellence), Bhopal (M.P.).** Our appreciation and gratitude to the management for granting us permission to conduct environment audit for the institute

We are genuinely touched by the helpful attitudes and cooperation displayed by all the faculty members and technical staff involved in the audit. Their valuable assistance and cooperation significantly contributed to the successful execution of the audit.

For- Empirical Exergy Private Limited

Rajesh Kumar Singadiya

(Director)

M.Tech (Energy Management),
Accredited Energy Auditor [AEA-0284]
Certified Energy Auditor [CEA-7271]
(BEE, Ministry of Power, Govt. of India)
Empanelled Energy Auditor with MPUVN, Bhopal M.P.
Lead Auditor ISO50001:2011 [EnMS) from FICCI, Delhi
Certified Water Auditor (NPC, Govt. of India)
Chartered Engineer [M-1699118], The Institution of Engineers (India)
Member of ISHRAE [58150]

CERTIFICATE OF ACCREDITATION

ENERGY IS LIFE
BEE
CONSERVE IT

BUREAU OF ENERGY EFFICIENCY

Examination Registration No.: EA- 7271
Accreditation Registration No.: AEA-284

Certificate of Accreditation

This is to certify that Mr./Ms. Shri. Rajesh Kumar Singadiya having its trade/registered office at ..... has been given accreditation as accredited energy auditor. The certificate shall be effective from 9th day of May, 2018

The certificate is subject to the provisions of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

This certificate shall be valid until it is cancelled under regulation 9 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

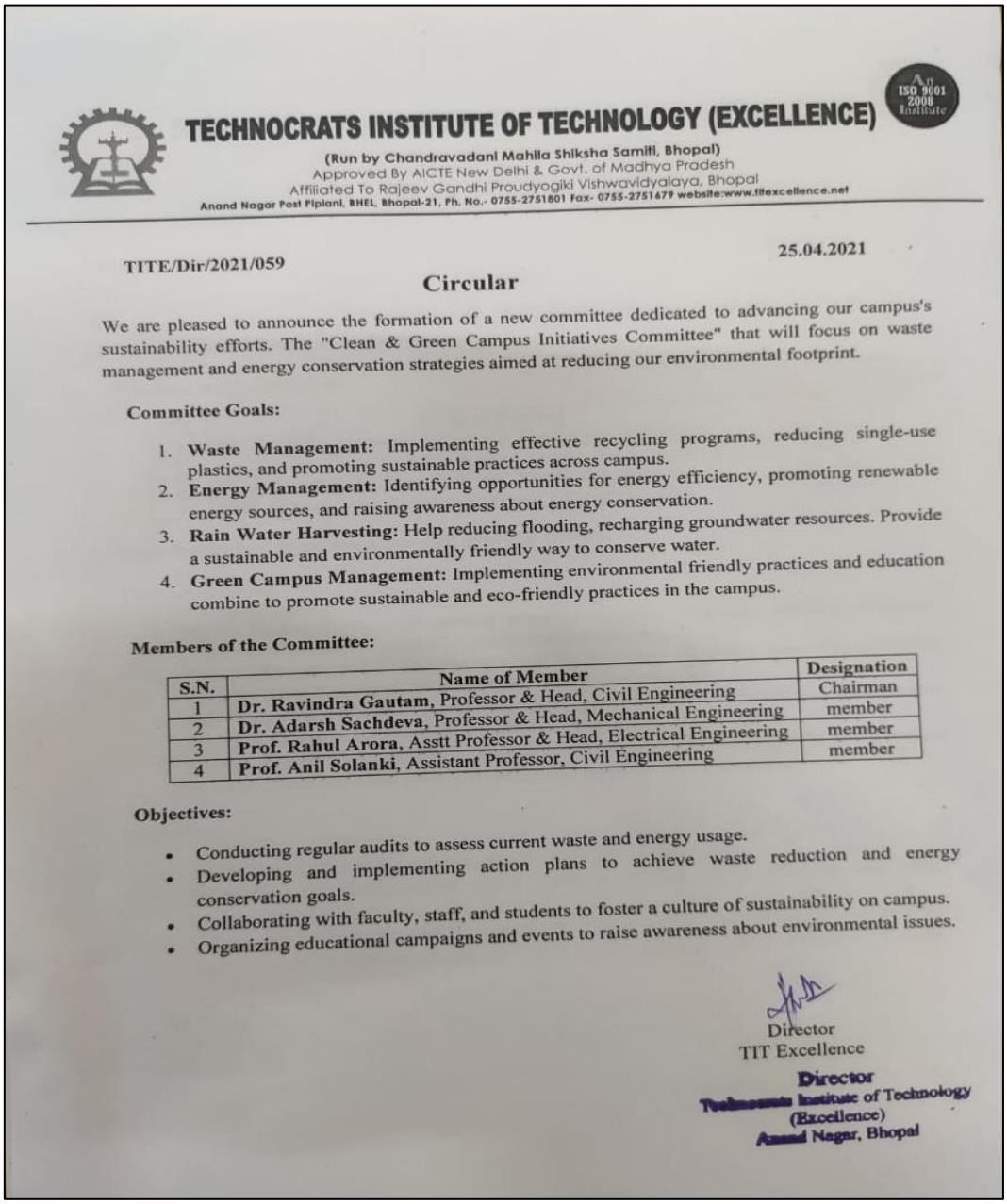
On cancellation, the certificate of accreditation shall be surrendered to the Bureau within fifteen days from the date of receipt of order of cancellation.

Your name has been entered at AEA No. 284 in the register of list of accredited energy auditors. Your name shall be liable to be struck out on the grounds specified in regulation 8 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

Given under the seal of the Bureau of Energy Efficiency, Ministry of Power, this 5th day of October, 2018

Secretary,
Bureau of Energy Efficiency
New Delhi

GREEN MONITORING COMMITTEE



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Anand Nagar Post Piplani, BHEL, Bhopal-21, Ph. No.- 0755-2751801 Fax- 0755-2751679 website:www.titexcellence.net

TITE/Dir/2021/059 25.04.2021

Circular

We are pleased to announce the formation of a new committee dedicated to advancing our campus's sustainability efforts. The "Clean & Green Campus Initiatives Committee" that will focus on waste management and energy conservation strategies aimed at reducing our environmental footprint.

Committee Goals:

1. **Waste Management:** Implementing effective recycling programs, reducing single-use plastics, and promoting sustainable practices across campus.
2. **Energy Management:** Identifying opportunities for energy efficiency, promoting renewable energy sources, and raising awareness about energy conservation.
3. **Rain Water Harvesting:** Help reducing flooding, recharging groundwater resources. Provide a sustainable and environmentally friendly way to conserve water.
4. **Green Campus Management:** Implementing environmental friendly practices and education combine to promote sustainable and eco-friendly practices in the campus.

Members of the Committee:

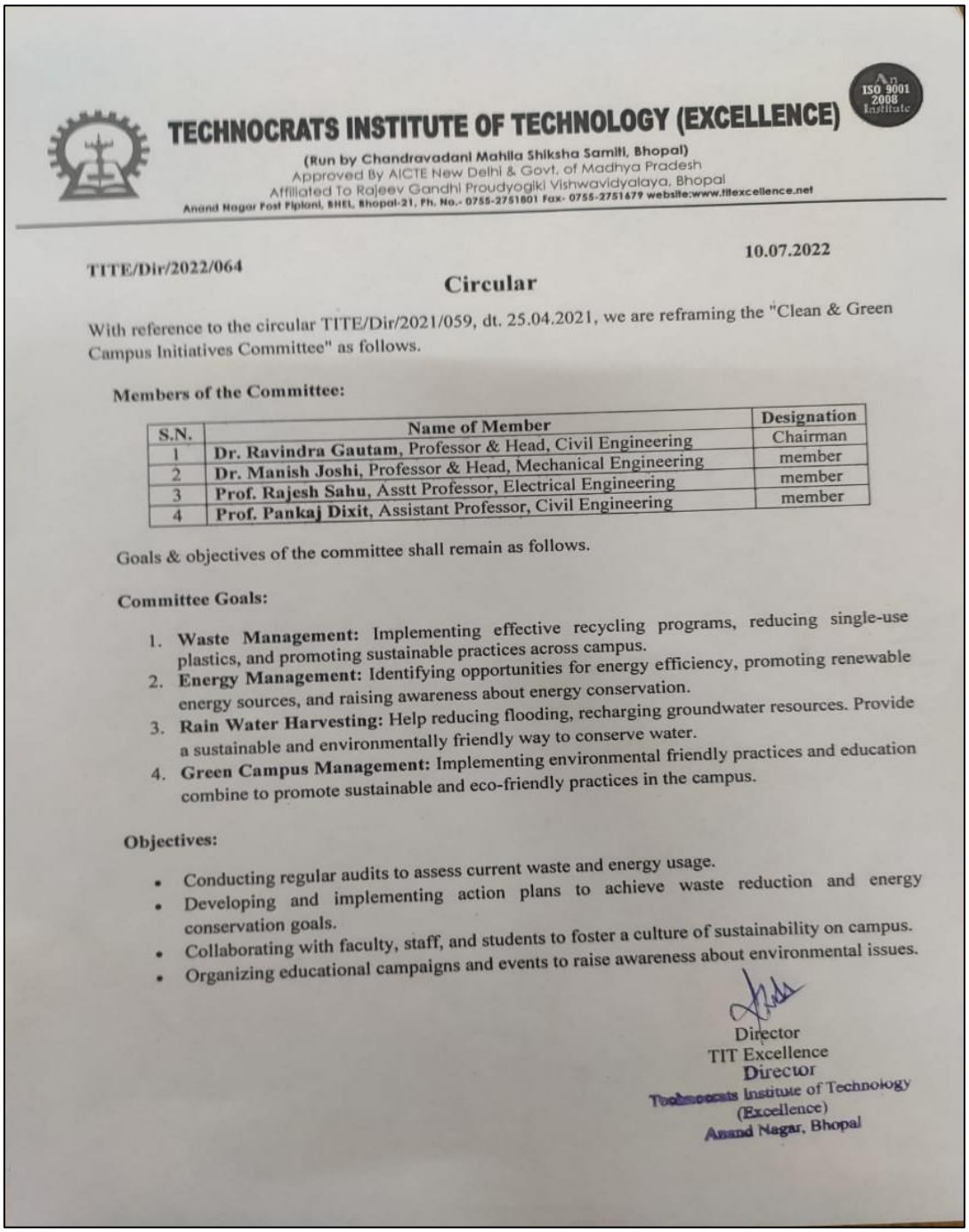
S.N.	Name of Member	Designation
1	**Dr. Ravindra Gautam**, Professor & Head, Civil Engineering	Chairman
2	**Dr. Adarsh Sachdeva**, Professor & Head, Mechanical Engineering	member
3	**Prof. Rahul Arora**, Asstt Professor & Head, Electrical Engineering	member
4	**Prof. Anil Solanki**, Assistant Professor, Civil Engineering	member

Objectives:

- Conducting regular audits to assess current waste and energy usage.
- Developing and implementing action plans to achieve waste reduction and energy conservation goals.
- Collaborating with faculty, staff, and students to foster a culture of sustainability on campus.
- Organizing educational campaigns and events to raise awareness about environmental issues.

Director
TIT Excellence

Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal



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TITE/Dir/2022/064

10.07.2022

Circular

With reference to the circular TITE/Dir/2021/059, dt. 25.04.2021, we are reframing the "Clean & Green Campus Initiatives Committee" as follows.

Members of the Committee:

S.N.	Name of Member	Designation
1	**Dr. Ravindra Gautam**, Professor & Head, Civil Engineering	Chairman
2	**Dr. Manish Joshi**, Professor & Head, Mechanical Engineering	member
3	**Prof. Rajesh Sahu**, Asstt Professor, Electrical Engineering	member
4	**Prof. Pankaj Dixit**, Assistant Professor, Civil Engineering	member

Goals & objectives of the committee shall remain as follows.

Committee Goals:

1. **Waste Management:** Implementing effective recycling programs, reducing single-use plastics, and promoting sustainable practices across campus.
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Director
TIT Excellence
Director
Technocrats Institute of Technology
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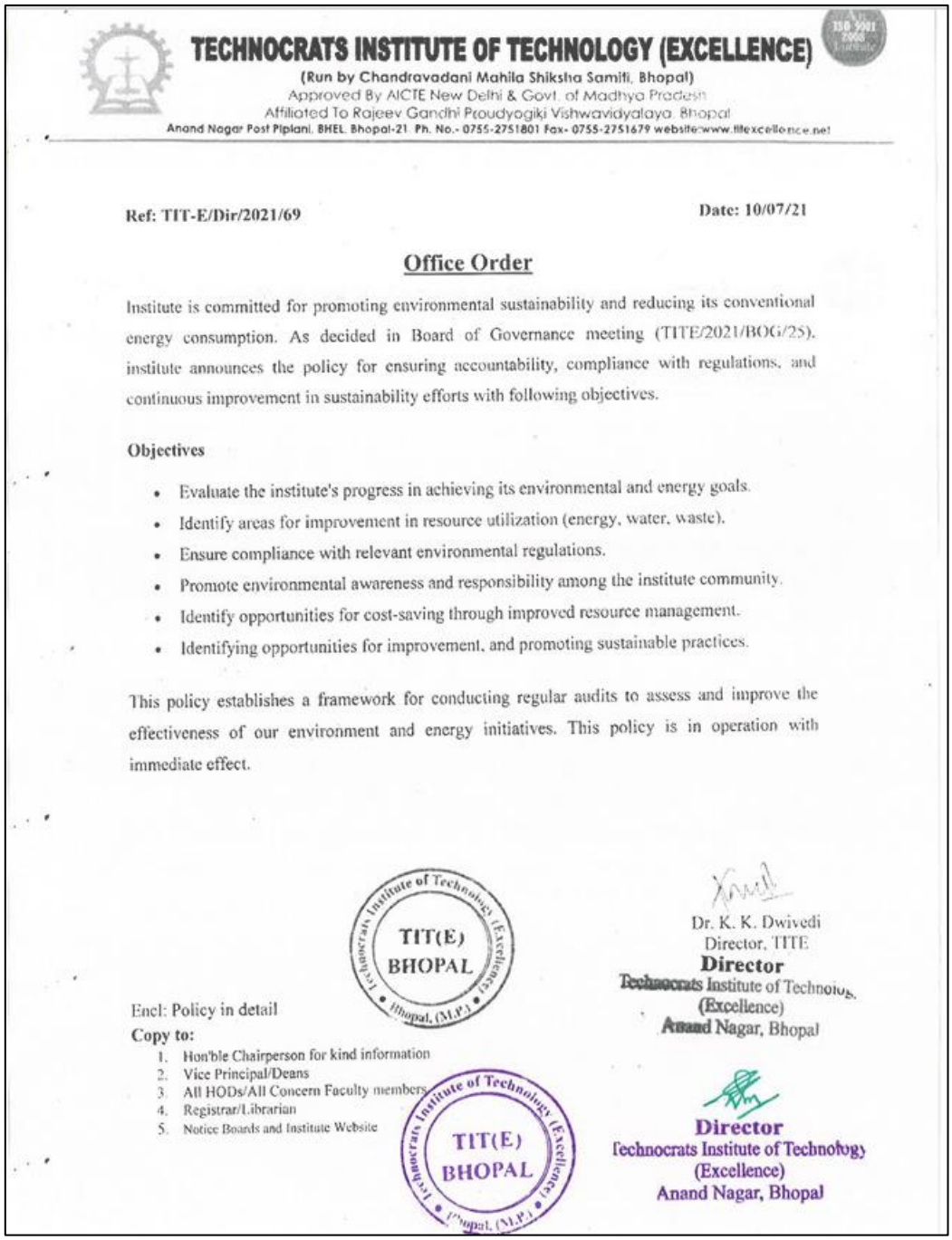
Anand Nagar, Bhopal

ENVIRONMENT AUDIT TEAM

The audit team constituted by the following senior technical executives from the **Empirical Exergy Private Limited,**

- **Mr. Rajesh Kumar Singadiya**[Director & Accredited Energy Auditor AEA-0284]
- **Ms. Laxmi Raikwar** [Energy Expert and Report Reviewer]
- **Mr. Ajay Nahra** [Sr.Project Engineer]
- **Mr. Charchit Pathak** [Sr.Project Engineer]
- **Mr. Mohan Choudhary** [Electrical Engineer]
- **Mr. Praveen Punasiya** [Field Engineer]

ENERGY ENVIRONMENT POLICY



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Ref: TIT-E/Dir/2021/69 Date: 10/07/21

Office Order

Institute is committed for promoting environmental sustainability and reducing its conventional energy consumption. As decided in Board of Governance meeting (TITE/2021/BOG/25), institute announces the policy for ensuring accountability, compliance with regulations, and continuous improvement in sustainability efforts with following objectives.

Objectives

- Evaluate the institute's progress in achieving its environmental and energy goals.
- Identify areas for improvement in resource utilization (energy, water, waste).
- Ensure compliance with relevant environmental regulations.
- Promote environmental awareness and responsibility among the institute community.
- Identify opportunities for cost-saving through improved resource management.
- Identifying opportunities for improvement, and promoting sustainable practices.

This policy establishes a framework for conducting regular audits to assess and improve the effectiveness of our environment and energy initiatives. This policy is in operation with immediate effect.

Technocrats Institute of Technology (Excellence) TIT(E) BHOPAL Bhopal (M.P.)

Dr. K. K. Dwivedi
Director, TITE
Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

Encl: Policy in detail

Copy to:
1. Hon'ble Chairperson for kind information
2. Vice Principal/Deans
3. All HODs/All Concern Faculty members
4. Registrar/Librarian
5. Notice Boards and Institute Website

Technocrats Institute of Technology (Excellence) TIT(E) BHOPAL Bhopal (M.P.)

Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

Policy for Audit on Environment and Energy Initiatives

INTRODUCTION:

Being a leader in the Technical Educational Institution in the state, the institute is committed to develop and implement Green and Sustainable energysystem in thewholecampus,whichwill as a consequence spreadtheawarenessandmotivationinthesociety to move toward clean and sustainable energy resources.

SCOPE:

Thispolicyappliestoall stakeholders, students, staff andvisitors

COMMITTEE FOR AUDIT:

- It comprises of senior faculty (preferably Professor) as nominated by Director.
- Three senior faculty members (preferably Professor) as nominated by Director.
- Administrative staff

RESPONSIBILITIES:

- Audit committee or team will be responsible fordeveloping and implementing the audit plan, analyze data, and prepare reports.
- Institute' administrative staff will provide necessary resources and support for conducting the audits.
- Faculty and staff will be responsible for implementing and maintaining environmental and energy initiatives.
- They will also cooperate with the audit process and implement recommended actions.
- Students will participate in awareness campaigns and promote environmentally responsible practices.

AUDIT FREQUENCY AND TYPES:

- Audits will be conducted biannually.
- It will include Green /Environment audit, Energy audit etc.

POLICY

The institute confirms its commitment to environment and energy initiatives through the following practices.

Technocrats Institute of Technology (Excellence) TIT(E) BHOPAL

Technocrats Institute of Technology (Excellence) TIT(E) BHOPAL

Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

1) Green audit / Environment audit
2) Energy audit
3) Clean and green campus initiatives
4) Beyond the campus environmental promotion activities

AUDIT DOCUMENTATION:

Audit committee

- Define outline requirements for documenting audit findings, conclusions, and recommendations.
- Define procedures for communicating audit results to relevant stakeholders, such as Institute' administration, faculty, and staff.
- Establish mechanisms for monitoring and tracking implementation of audit recommendations.

REVIEW

This policy will be reviewed and updated periodically if necessary to reflect changes in environmental regulations, best practices, and the Institute's evolving sustainability goals.

CONCLUSIONS:

By developing a comprehensive policy that addresses these aspects, the Institute effectively strives to continuously improve its environmental performance and contribute to a more sustainable future.

Dr. K. K. Dwivedi
Director, TITE
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

Discussed & finalized in meeting of Academic Council (TITE/2021/ACM/25) and submitted for information and approval in Board of Governance meeting.

Technocrats Institute of Technology (Excellence) TIT(E) BHOPAL Bhopal (M.P.)

Technocrats Institute of Technology (Excellence) TIT(E) BHOPAL Bhopal (M.P.)

Ms. Sadhna Karsoliya
Chairperson, TITE

Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

POLICY ON ENERGY AND WATER CONSERVATION

TECHNOCRATS INSTITUTE OF TECHNOLOGY (EXCELLENCE)
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Ref: TIT-E/Dir/2021/68 Date: 09/07/21

Office Order

Institute is committed for energy conservation and fostering a culture of environmental responsibility among faculty, staff, and students. As decided in Board of Governance meeting (TITE/2021/BOG/25), institute announces the policy for ensuring energy conservation within the campus with following objectives.

Objectives

- Reduce overall energy consumption within the college.
- Promote the use of energy-efficient technologies and practices.
- Raise awareness about energy conservation through education and outreach programs.
- Continuously monitor and improve energy efficiency across the college.

The aim of this policy is to encourage and adopt practices that would lead to sustainable development, minimize carbon foot prints and depletion of natural resources and maximize recycling of resources. This policy is in operation with immediate effect.

Dr. K. K. Dwivedi
Director, TITE
Director
Technocrats Institute of Technology (Excellence)
Anand Nagar, Bhopal

Encl: Policy in detail

Copy to:

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Director
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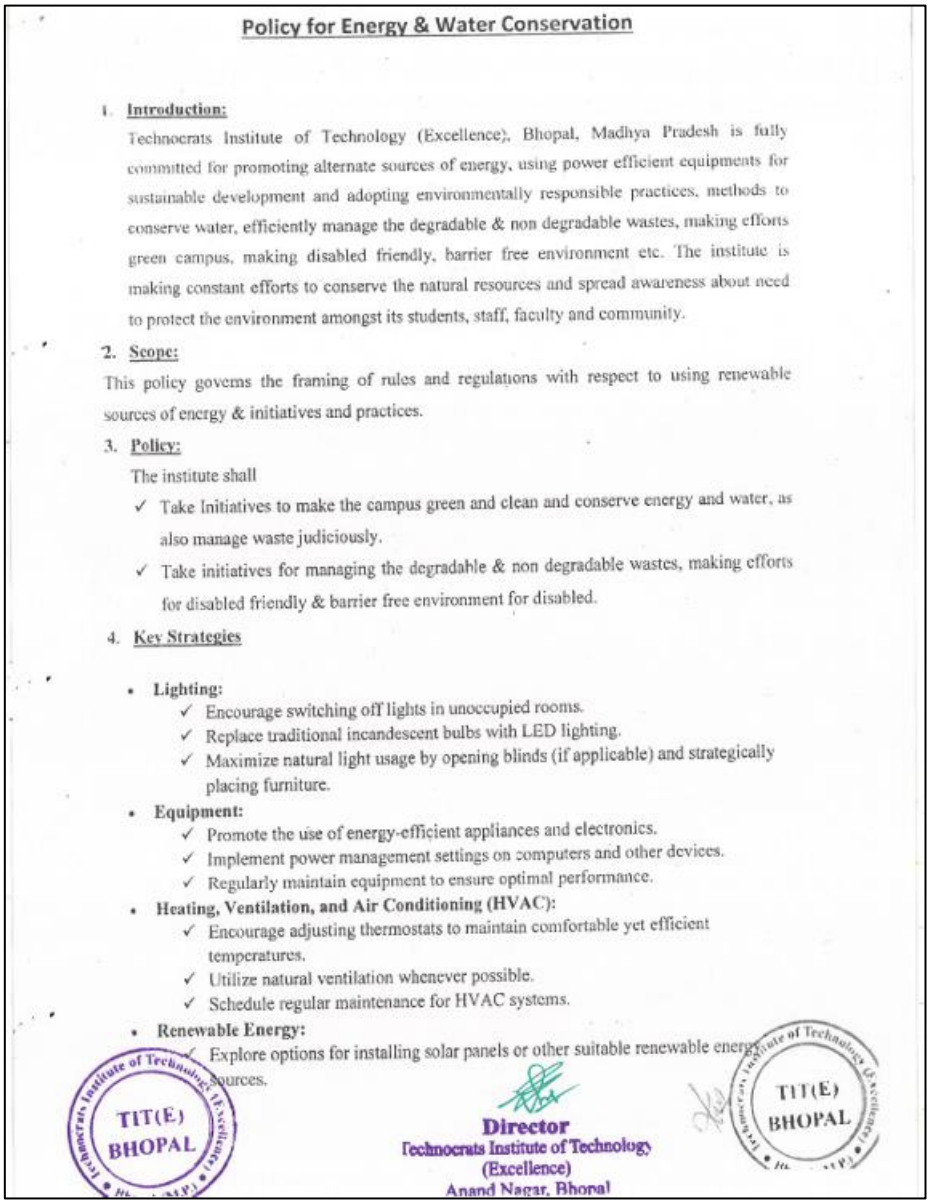
Anand Nagar, Bhopal



Policy for Energy & Water Conservation

1. **Introduction:**

Technocrats Institute of Technology (Excellence), Bhopal, Madhya Pradesh is fully committed for promoting alternate sources of energy, using power efficient equipments for sustainable development and adopting environmentally responsible practices, methods to conserve water, efficiently manage the degradable & non degradable wastes, making efforts green campus, making disabled friendly, barrier free environment etc. The institute is making constant efforts to conserve the natural resources and spread awareness about need to protect the environment amongst its students, staff, faculty and community.

2. **Scope:**

This policy governs the framing of rules and regulations with respect to using renewable sources of energy & initiatives and practices.

3. **Policy:**

The institute shall

- ✓ Take Initiatives to make the campus green and clean and conserve energy and water, as also manage waste judiciously.
- ✓ Take initiatives for managing the degradable & non degradable wastes, making efforts for disabled friendly & barrier free environment for disabled.

4. **Key Strategies**

- **Lighting:**
  - ✓ Encourage switching off lights in unoccupied rooms.
  - ✓ Replace traditional incandescent bulbs with LED lighting.
  - ✓ Maximize natural light usage by opening blinds (if applicable) and strategically placing furniture.
- **Equipment:**
  - ✓ Promote the use of energy-efficient appliances and electronics.
  - ✓ Implement power management settings on computers and other devices.
  - ✓ Regularly maintain equipment to ensure optimal performance.
- **Heating, Ventilation, and Air Conditioning (HVAC):**
  - ✓ Encourage adjusting thermostats to maintain comfortable yet efficient temperatures.
  - ✓ Utilize natural ventilation whenever possible.
  - ✓ Schedule regular maintenance for HVAC systems.
- **Renewable Energy:**
  - ✓ Explore options for installing solar panels or other suitable renewable energy sources.

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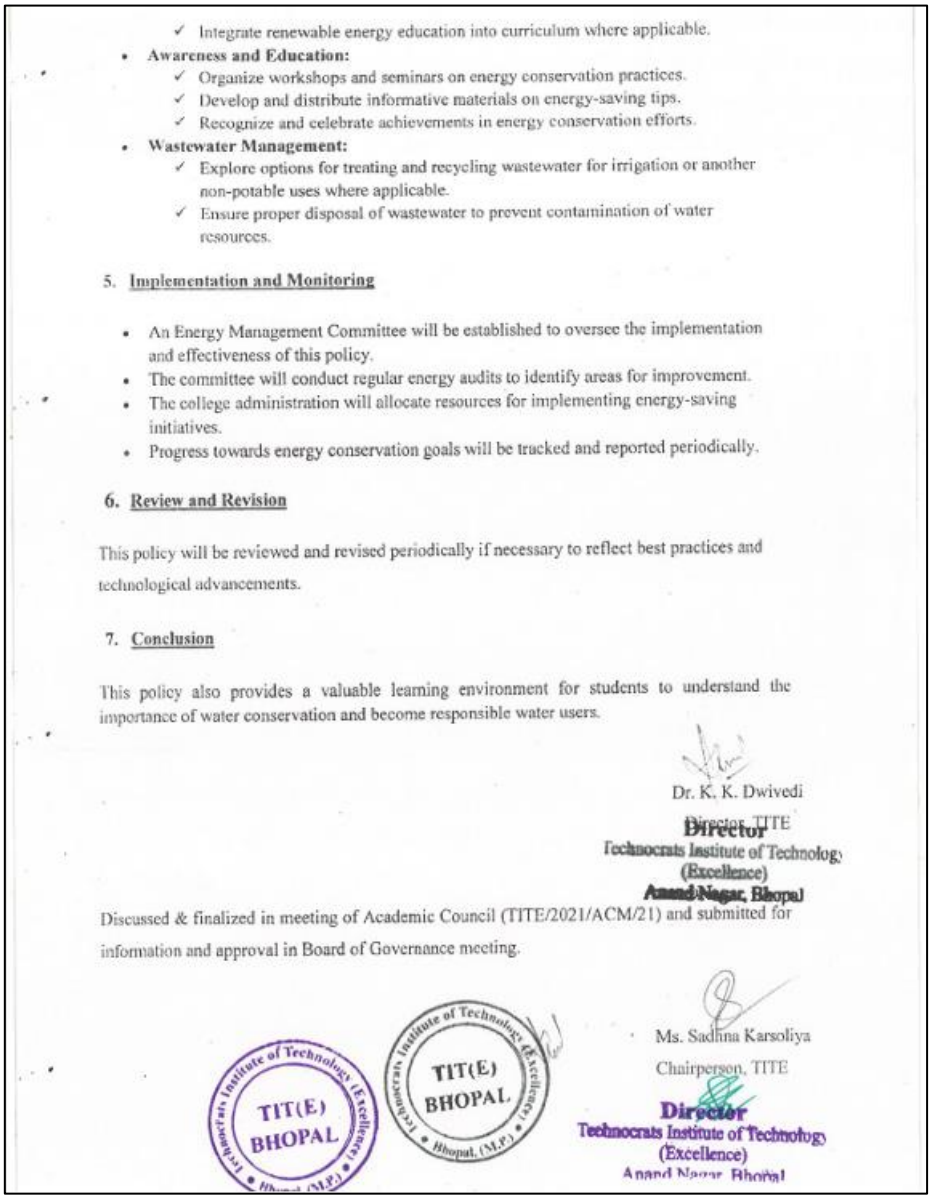

- ✓ Integrate renewable energy education into curriculum where applicable.

- **Awareness and Education:**
  - ✓ Organize workshops and seminars on energy conservation practices.
  - ✓ Develop and distribute informative materials on energy-saving tips.
  - ✓ Recognize and celebrate achievements in energy conservation efforts.
- **Wastewater Management:**
  - ✓ Explore options for treating and recycling wastewater for irrigation or another non-potable uses where applicable.
  - ✓ Ensure proper disposal of wastewater to prevent contamination of water resources.

5. **Implementation and Monitoring**

- An Energy Management Committee will be established to oversee the implementation and effectiveness of this policy.
- The committee will conduct regular energy audits to identify areas for improvement.
- The college administration will allocate resources for implementing energy-saving initiatives.
- Progress towards energy conservation goals will be tracked and reported periodically.

6. **Review and Revision**

This policy will be reviewed and revised periodically if necessary to reflect best practices and technological advancements.

7. **Conclusion**

This policy also provides a valuable learning environment for students to understand the importance of water conservation and become responsible water users.

Dr. K. K. Dwivedi
Director, TITE
Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

Discussed & finalized in meeting of Academic Council (TITE/2021/ACM/21) and submitted for information and approval in Board of Governance meeting.

TIT(E) BHOPAL

Ms. Sadhna Karsoliya
Chairperson, TITE
Director
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Anand Nagar, Bhopal

EXECUTIVE SUMMARY

The executive summary of the environment audit report presented in this section briefly outlines the identified water conservation measures and recommendations proposed during the project.

WATER CONSERVATION PROJECT TAKEN BY INSTITUTE

- **Rainwater Harvesting System**

The institute has successfully installed a "Rainwater Harvesting System" on the Technocrats Institute of Technology (Excellence), for blocks to maintain the groundwater level. This system saves about 80 to 85 % of the building's rooftop rainwater. It's appreciable.

- **Sprinkler System**

The institute has a "Water Sprinkler System" for the in the garden. It's appreciable.

- **Wastewater Treatment Plant**

Technocrats Institute of Technology (Excellence), has an STP (Sewage Treatment Plant) under construction for wastewater generated from various activities on the campus. It's appreciable.

ENVIRONMENT AUDIT RECOMMENDATION

- **Fresh Water Monitoring System**

  Installation of a “Cloud-based (IoT) Groundwater Extraction Monitoring System” for bore-well to quantify freshwater consumption per day in the college **OR** Install water flow meters (Mechanical or Electronics) on the bore-well for quantify per day water consumption.

- **Sensor Based Water Taps**

  Installation of 'sensor-based water taps' reduces water wastage.

- **Use Efficient Urinal Taps And Sensor Based Water Taps**

  Replacing these inefficient fixtures with Water Sense-labelled flushing urinals can save between 0.5 to 0.4 litres per flush without sacrificing performance. Installing water-saving flushing urinals will not only reduce water use in facilities but also save on pumping energy costs in water bills.

- **Installation of Water over Flow Sensor in Water Tanks**

  It was observed that water overflows from the overhead tanks. Therefore, it is recommended to install a water overflow sensor to prevent overflow from the tanks."

- **Awareness and Training program**

  Conduct awareness and training program, poster presentation to promote water conservation and sustainable development activities in the institute.

Chapter-1
INTRODUCTION

1.1 About Institute

Technocrats Institute of Technology (Excellence), Bhopal, is one of the premier institutes of Madhya Pradesh. This is an educational institute which is known in central India for imparting quality & value-based education for the past 12 years. This institute was started with a clear vision to develop the institute into a center of excellence in engineering education in the country with global standards. The institute is affiliated to Rajiv Gandhi Proudyogiki Vishwavidyalaya (RGPV), Bhopal for B.Tech, M.Tech , MCA programs & affiliated to Barkatullah University, Bhopal for MBA program. The institute is located in Anand Nagar, Raisen Road, Bhopal.

The institute offers six courses at undergraduate level leading to bachelor's degree, B.Tech. in Electronics & Communication Engineering, Computer Science & Engineering, Civil Engineering, Electrical Engineering, Mechanical Engineering and CSE (Artificial Intelligence & Machine Learning) disciplines. Apart from these courses, institute also offers admissions in master's degree, M.Tech. in Computer Science & Engineering, Construction Technology & Management and CSE (Artificial Intelligence & Machine Learning), Master of Computer Application (MCA) & Master of Business Administration (MBA). Presently the total intake is 600 in UG courses and 450 in PG courses.

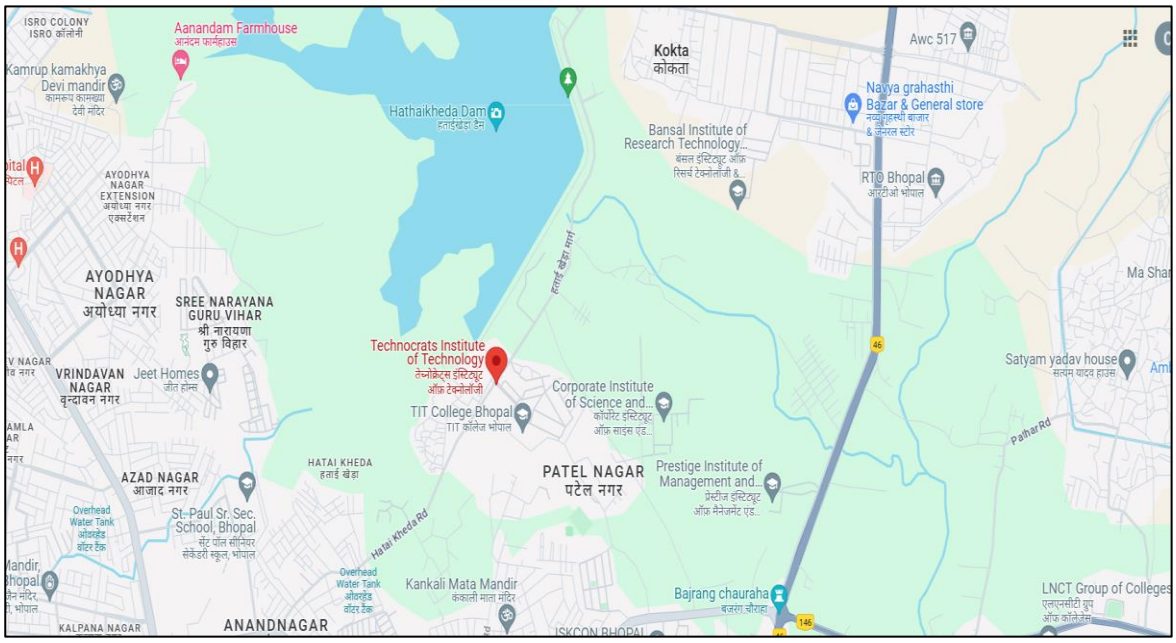


Figure 1.1: Source: Satellite Image of TIT-Excellence

Vision of the Institute

To become a "Centre of Excellence" for quality education in the field of engineering, research and management so as to produce globally competent and socially responsible professionals, who can contribute in technological and socio-economic development of the nation as a whole and region in particular.

Mission of the Institute

M.1: To educate students with deep professional knowledge through innovative teaching-learning process and to make them aware of cutting edge technology so as to become capable of understanding and addressing the issues of society, state and the country.

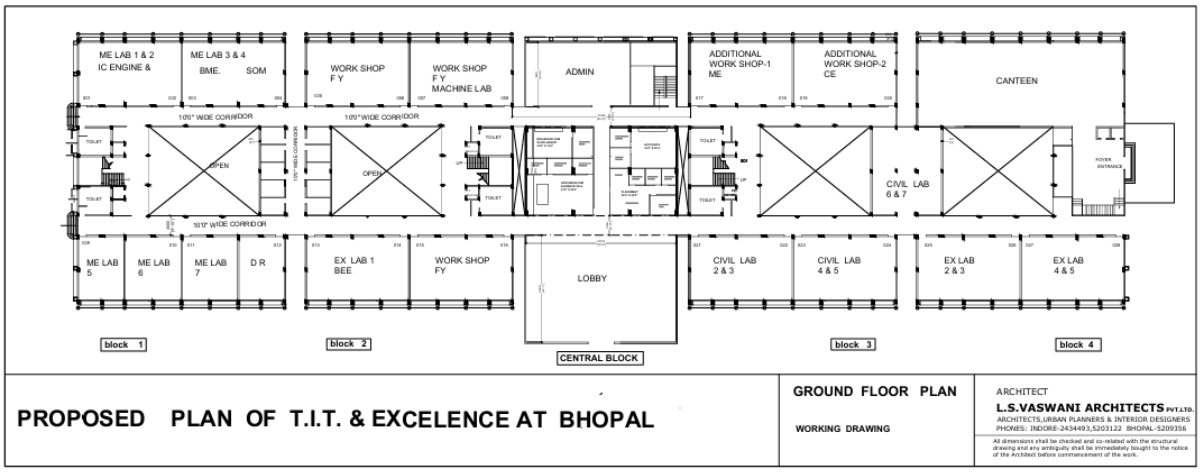
M.2: To create in- house facilities for research and innovation to provide solution to the industrial problems.

M.3: To inculcate right human values and professional ethics, leadership qualities, communication and entrepreneurship skills in students to meet the need of society.

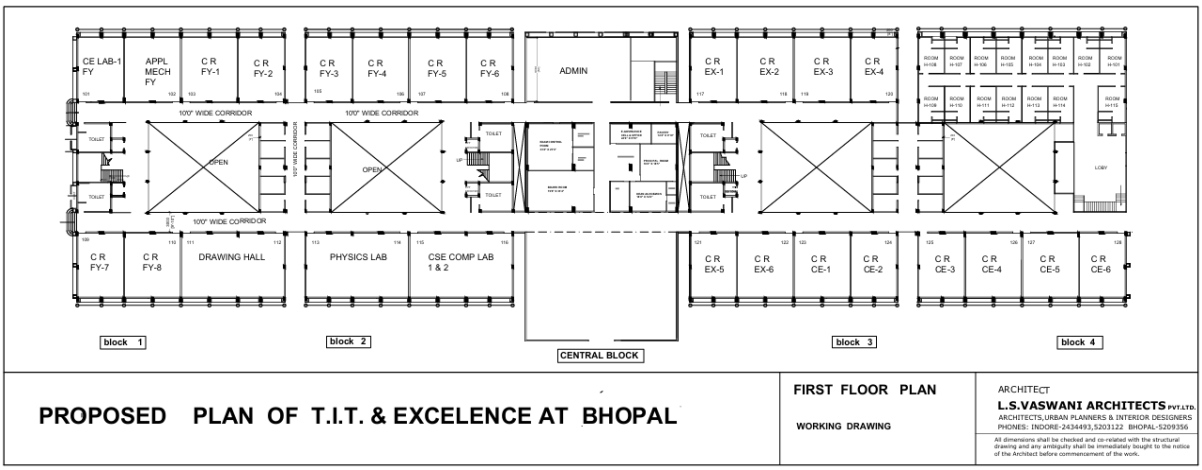
Institute Population

Sr. No.	Year	Teaching Staff (No.)	Non -Teaching Staff (No.)	Student (No.)
1	2020-21	212	98	2493
2	2021-22	212	98	2644
3	2022-23	213	98	2735

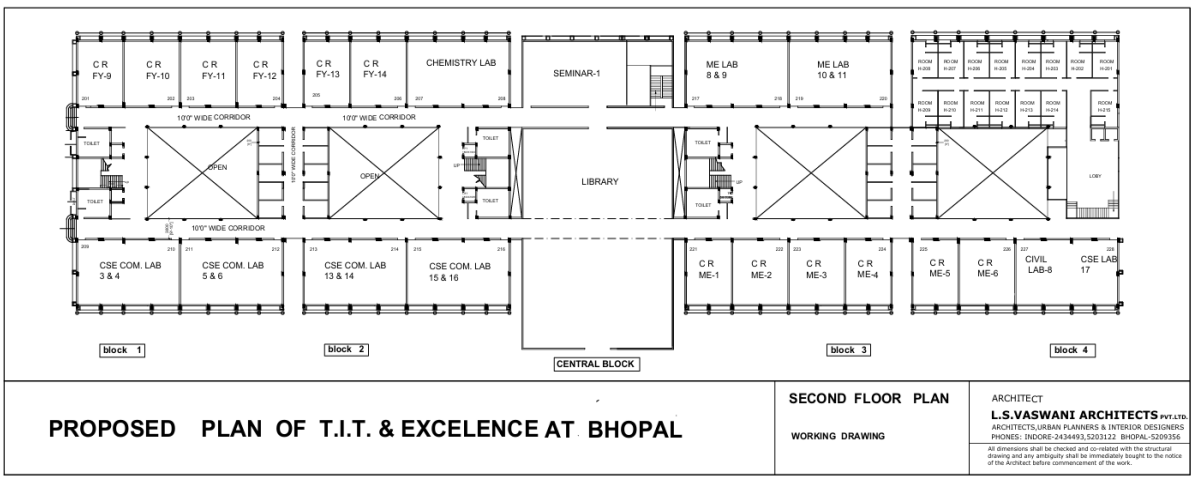
Institute Layout (Ground Floor Plan)



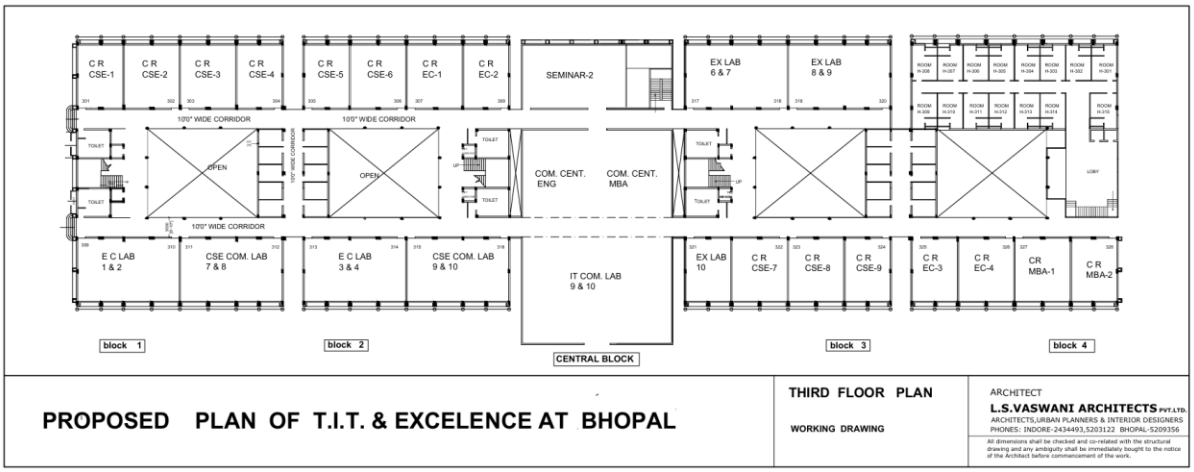
Institute Layout (First Floor Plan)



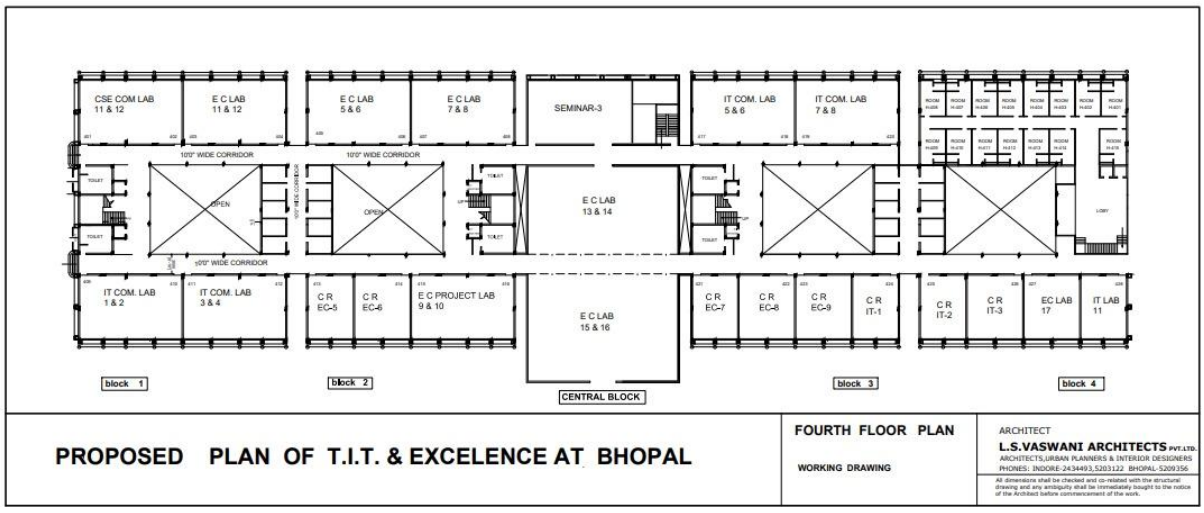
Institute Layout (Second Floor Plan)



Institute Layout (Third Floor Plan)



Institute Layout (Fourth Floor Plan)



1.2 About Environment Audit

An environmental audit can be a highly valuable tool for education institutes and the universities in a wide range of ways to improve their energy, environmental, and economic performance while reducing waste and operating costs. Environmental audits provide a basis for calculating the economic benefits of water conservation projects by establishing the current rates of water use and their associated costs.

1.3 Objectives of Environment Audit

The general objective of environment audit is to prepare a baseline report on water conservation measures to mitigate consumption, improve quality and sustainable practices.

The specific objectives are

- To monitor the water consumption and water conservation practices.
- To assess the quantity of water, usage, quantity of waste water generation and their reduction within the campus.

1.4 Target Areas of Environment Audit

This indicator addresses water sources, water consumption, irrigation, storm water, appliances and fixtures aquifer depletion and water contamination are taking place at unprecedented rates. It is therefore essential that any environmentally responsible institution should examine its water use practices.

1.5 Methodology followed for conducting Environment audit

Step 1: Walk through the survey

- Understanding of existing water sourcing, storage, and distribution facility.
- Assessing the water demand and water consumption areas.
- Preparation of a detailed water circuit diagram.

Step 2: Secondary Data Collection

- Analyse historical water use and wastewater generation
- Field measurements for estimating current water use
- Metered & unmetered supplies.
- Understanding of "base" flow and usage trends at site
- Past water bills
- Wastewater treatment scheme & costs etc.

Step 3: Site Environment Audit Planning (based on-site operations and practices)

- Preparation of a water flow diagram to quantify water use at various locations
- Wastewater flow measurement and sampling plan

Step 4: Conduction of Detailed Environment Audit and Measurements

- Conduction of field measurements to quantify water/wastewater streams
- Power measurement of pumps/motors
- Preparation of water balance diagram
- Establishing a water consumption pattern
- Detection of potential leaks & water losses in the system
- Assessment of productive and unproductive usage of water
- Determine key opportunities for water consumption reduction, reuse & recycle.

Step 5: Preparation of Environment Audit Report

- Documentation of collected & analyzed water balancing and measurement details
- Projects and procedures to maximize water savings and minimize water losses.
- Opportunities for water conservation based on reduce/recycle/reuse and recharge option

CHAPTER- 2
WATER CONSUMPTION AND WASTEWATER SOURCES

2.1 Details of the source of fresh water and use areas

The main sources of freshwater for the institute is bore-wells. Freshwater is primarily used for drinking, housekeeping, gardening, and domestic activities. The institute has three bore-well at different location in the campus. Details of the bore well are given in Table 2.1

Table 2.1: Fresh Water sources in the institute

Sr. No.	Location	No. of bore-well	Rated (HP)
1	Front of Excellence building	1	7.5
2	Near Nursery	1	7.5
3	Near Main gate	1	7.5

2.2 Water Accounting and Meter system

It was observed that there is requirement of water flow meters on bore-wells to quantify per day ground water extraction from different bore-well.

Fig.2.1: Fresh Water source (Bore-wells) in the campus

2.3 Fresh Water Flow Distribution Diagram

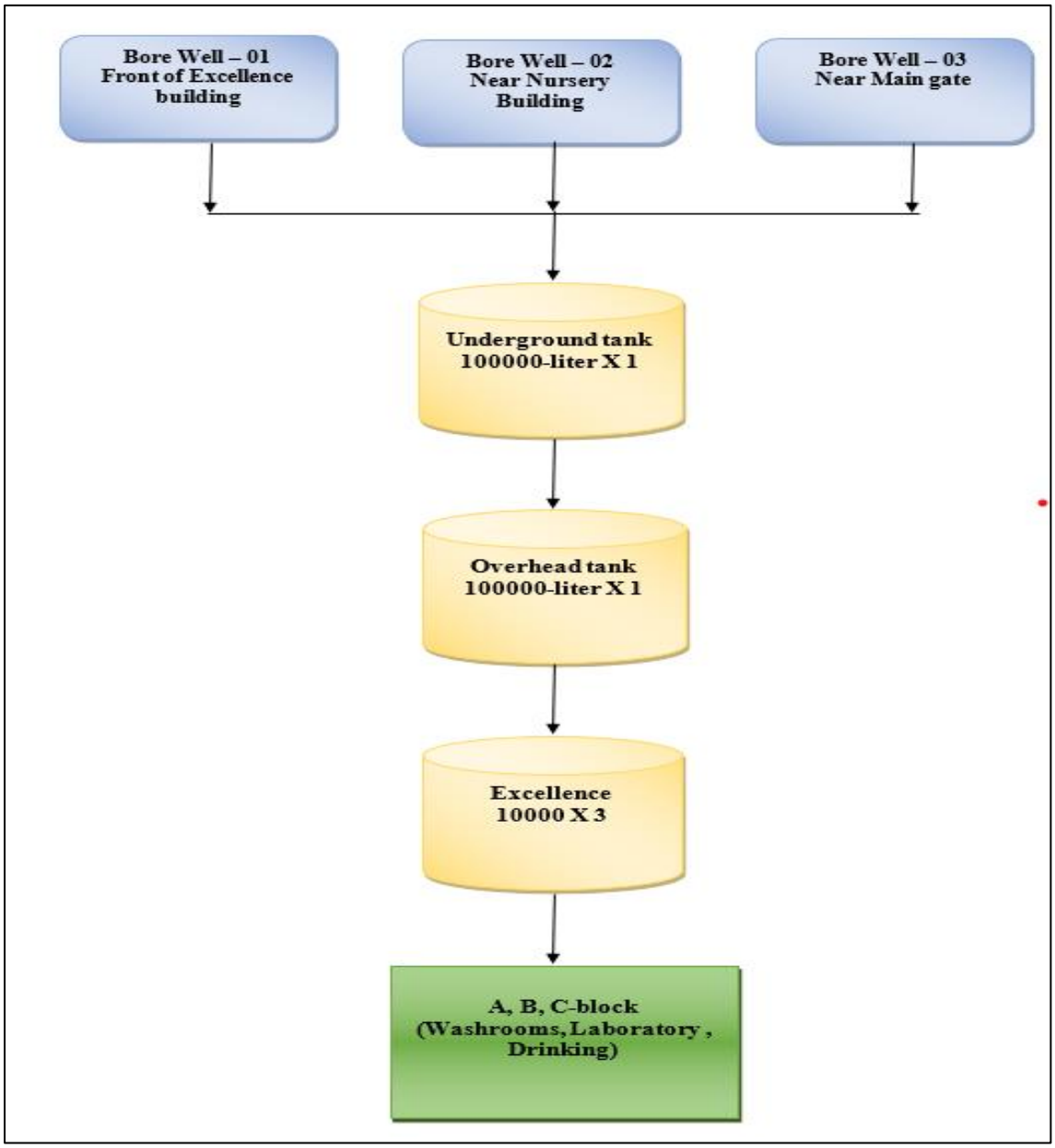


Fig. 2.2 Fresh Water flow diagram for Excellence building

2.4 Water storage capacity in institute

The institute has different types of water storage tanks, including PVC and RCC. Details of the tanks are given in the table.2.2

Table: 2.2 Detailed of Water Storage Tanks

Sr. No.	Location	Type of Tank	Unit Capacity (Liter)	Quantity (No's)	Total Capacity (Liter)
1	Near Excellence building	Concrete	1,00,000	1	1,00,000
2	Near Excellence building	Concrete	1,00,000	1	1,00,000
3	Excellence building	Concrete	10,000	3	30,000
4	Excellence building	PVC	5,000	1	5,000
Total Water Storage Capacity					2,35,000

Fig.2.3: Water storage tank in the campus

2.5 Water Use Areas in Institute

Water is preliminary used for drinking, domestic, and gardening. The environment audit team visited various departments and buildings to determine appliances. The details of the washroom, toilet, and taps are given in the table 2.3

Table: 2.3 Details of washroom and use taps in various areas

Sr. No.	Location	Urinal	Washbasin	Taps
1	A-block	28	20	32
2	B-block	12	12	18
3	C-block	14	4	6
Total		54	36	56

Fig.2.4: Water Taps and Washbasin in institute

2.6 Water Coolers in institute

The management has installed water cooler in every block. Details are provided in Table 2.4.

Table 2.4: Water cooler Location and Numbers

Sr. No.	location	Quantity (No's)
1	A-block	1
2	B-block	1
3	C-block	1
3	Canteen	1
Total no of water cooler		4

2.7 Freshwater Use Lawn Area

The management has installed water sprinkler system for efficient water utilisation lawn area.

It's Appreciable.

Fig. 2.5: Water sprinkler system for efficient water utilisation

Fresh water use in Garden: It was observed that there is potential for apply drip irrigation system in garden for watering in plants and trees.

Fig. 2.6: Fresh Water use in Garden

Recommendation:

The one of major contribution of fresh water consumption is watering for plants and gardening in college campus. There is good potential for water saving by adopts "Automatic Watering 360 adjustable misting nozzle irrigation Dripper's system" for plants. Adjustable drip irrigation tools to provide different amounts of water depending on the water requirements of different plants. The drip speed can be set as for indoor and outdoor plants.

Figure: - 2.7 Recommended "Drip irrigation System" for Watering in the plant

2.8 Wastewater Generation Sources

At present, wastewater is generated from various departments and other activities such as washrooms and hand washing. Details of the wastewater generation sources and their locations are provided in the table 2.5

Table: 2.5 Waste Water Generation Sources

Sr. No.	Location	Type of water used	Water consuming activities
1	A-block	Fresh water	Drinking, washrooms activities
2	B- block	Fresh water	Drinking, washrooms activities
3	C- block	Fresh water	Drinking, washrooms activities

CHAPTER-3
AIR QUALITY MEASUREMENT

3.1 Air Quality Measurement

The audit team conducted an air monitoring survey on the in the institute. Details are provided in the table 3.1

A-block					
Sr. No.	**Location**	**$PM_{2.5}$**	**PM_{10}**	**Particle**	**CO_2**
1	A01	16.6	24.7	3954	431
2	A02	15	23.8	2322	447
3	A 03	14.8	24.8	3521	428
4	A 04	15.9	24.5	3408	452
5	Office	16.7	27.7	3682	631
6	Director Room	18.1	22.4	3584	593
7	EXECUTIVE Director Office	18.4	24.1	3682	598
8	Electrical Lab	18.3	29.7	3497	499
9	RAC lab	18.6	27.4	3658	415
10	A 07	20	32.8	4072	409
11	A 09	19.4	31.1	3794	408
12	A 10	16.2	26.2	3550	409
13	A 12	18.7	27.2	3650	412
14	A 13	16.4	24.6	3541	416
15	Strength of Material Lab	15.6	28.1	3556	415
16	A 101	21.4	33.9	4179	427
17	A 102	25.6	28.7	4247	422
18	A 103	17.8	29.8	3875	408
19	A104	17.2	30.8	3354	421
20	A 105	17.5	32.1	3267	412
21	A 106	18.2	36.4	3658	409
22	A 111	16.4	38.1	3549	431
23	A 112	15.3	34.1	3481	495
24	A113	16	26.7	3950	460
25	A 114	21	36.4	4366	450
26	A 115	28.1	55.2	4653	437
27	A 116	20.8	32.1	4607	452
28	A 117	16.8	21.4	4541	520
29	A 118	21.1	36.2	4047	553
30	A 201	15.4	25.8	3072	528
31	A 202	17.4	26.9	2684	547
32	A 202 II	13.4	23.6	3400	440

Continue….

Sr. No.	Location	$PM_{2.5}$	PM_{10}	Particle	CO_2
33	A 203	20.2	36.5	3233	451
34	A 209	22.2	38.5	3432	425
35	A 210	16.8	27.5	3320	472
36	A 211	17.4	22.4	3116	466
37	A 212	18.2	26.4	3216	422
38	A 213	16.6	26.7	3265	431
39	A 301	16.5	26.7	3265	447
40	A 302	16.2	28.8	3802	495
41	A 303	16.2	36.2	3438	460
42	A 305	16.9	27.8	3356	450
43	A 306	19.4	54.6	2322	412
44	A 307	16.3	45.7	3521	416
45	A 308	18.6	24.6	3408	415
46	A 309	17.3	28.1	3682	427
47	A 310	17.8	33.9	3584	422
48	A 312	19.3	28.7	3682	408
49	A 313	16.3	29.8	3497	421
50	A 314	17.3	30.8	4179	412
51	A 315	17.1	32.1	4247	409
52	A 316	16.7	36.4	3875	431
53	A 317	17.7	25.7	3354	427
54	A 318	16.3	27.7	3267	462
55	A 319	17.8	26.4	3658	502
56	A 401	16.8	32.4	3549	517
57	A 402	21.1	26.5	3481	531
58	A 403	15.4	31.2	3950	435
59	A 404	17.9	29.7	4366	481
60	A 405	13.4	29.8	3325	471
61	A 406	20.2	31.7	3865	466
62	A 408	22.2	27.7	3954	468
63	A 410	16.8	30.4	2322	454
64	A 411	17.4	28.4	3521	475
65	A 413	18.2	26.7	3408	482
66	A 414	16.6	26.7	3682	520
67	A 415	16.5	28.8	3584	323

Observation

- $PM_{2.5}$ value is acceptable range. The 24-hour concentration of $PM_{2.5}$ is considered unhealthy when it rises above **35.4** $\mu g/m^3$
- PM_{10} value is an acceptable range. It should be below **155** $\mu g/m^3$
- CO_2 value is an acceptable range. It should be below 1000 ppm

B-block					
Sr. No.	**Location**	**$PM_{2.5}$**	**PM_{10}**	**Particle**	**CO_2**
68	B04	16.2	36.2	3682	520
69	B 05	16.2	27.8	3497	553
70	B 06	16.9	21.6	5439	528
71	B 07	18.1	29.7	3794	547
72	B 08	17.7	22.4	3550	440
73	B 09	17.5	24.7	3650	451
74	B 10	16.6	23.8	3541	425
75	B 11	15	43.5	3556	472
76	B 12	16.5	23.8	6583	521
77	B 13	21.3	24.8	6593	516
78	B 14	27.3	26.3	6452	502
79	Civil Engg. Lab	20.8	27.7	8463	517
80	Engg. Geology lab	19.4	22.4	9562	531
81	B.M.E Lab	16.4	47.7	3432	435
82	Class Room	17.2	56.7	3320	481
83	Class Room	18.4	29.7	3116	471
84	Class Room	16.7	29.8	3216	502
85	Class Room	26.5	31.7	3265	517
86	Store Room	19.4	27.7	3265	531
87	Dept. of Civil Engg. Office	16.3	30.3	3802	435
88	Civil Library	18.6	28.4	3438	481
89	Class Room	17.3	26.3	3356	471
90	Class Room	17.8	29.3	3845	466
91	Class Room	19.3	21.3	3395	468
92	Wash Room	16.3	22.1	3865	454
93	Staff Wash Room	17.3	21.4	3320	475
94	CAD LAB	17.1	36.2	3116	482
95	Class Room	16.7	25.8	3216	520
96	Class Room	22.2	46.7	3265	323
97	Class Room	16.8	65.8	3265	520
98	Tutorial Room	17.4	45.9	3802	553
99	Class Room	18.2	64.7	3438	528
100	NCC Office	16.6	76.3	3356	547
101	Yoga Meditation	15.3	45.9	3845	440
102	Dept. of Elec. & Electronic HOD	17.7	24.6	3395	451
103	Control System Lab	17.5	28.1	3865	425

Sr. No.	Location	$PM_{2.5}$	PM_{10}	Particle	CO_2
104	Near Control System Lab	16.6	33.9	5389	472
105	Wash Room	15.2	28.7	5390	482
106	Wash Room (Male)	14.8	29.8	3794	520
107	Wash Room Boys	15.9	30.8	3550	323
108	Tutorial Room	16.7	32.1	3650	520
109	Tutorial Room	18.1	36.4	3541	553
110	PG Research Lab	18.4	57.9	3556	528
111	Software Engg	18.3	75.6	4179	547
112	Tutorial Room	18.6	45.6	4247	440
113	Class Room	19.4	35.7	3875	451
114	Computer Networking Lab	47.9	54.8	3354	425
115	T & P Cell	35.2	54.2	3267	472
116	T&P Hall	35.5	29.8	3658	440
117	Seminar Hall	43.6	30.8	3549	451
118	Wash Room Boys	19.3	32.1	3481	425
119	Wash Room Girls	16.3	36.4	3950	472
120	Wash Room Boys	17.3	38.1	4366	523
121	Class Room	17.1	34.1	4653	523
122	Class Room	16.7	35.7	4607	527
123	EDC Project Lab	17.7	53.5	3622	589
124	Tutorial Room	16.3	54.7	3541	534
127	Class Room	21.1	35.0	3035	521
128	T&P Hall	21.8	33.7	4057	431
129	Wash Room	31.6	35.9	7392	502
130	Wash Room	32.6	36.9	2745	517

C-block					
Sr. No.	**Location**	**$PM_{2.5}$**	**PM_{10}**	**Particle**	**CO_2**
131	Conference Hall	19.8	42.7	3659	531
132	Conference Hall	17.7	47.9	3649	435
133	Guest Room	17.5	35.7	3794	481
134	Room	16.6	35.7	8563	471
135	Room	15.2	35.7	3648	466
136	Seminar Hall T&P	14.8	5527	4859	468
137	PPT Hall	15.9	32.1	3794	454
138	Boys Hostel	16.7	25.1	3550	475
139	GYM	22.5	32.7	5436	432

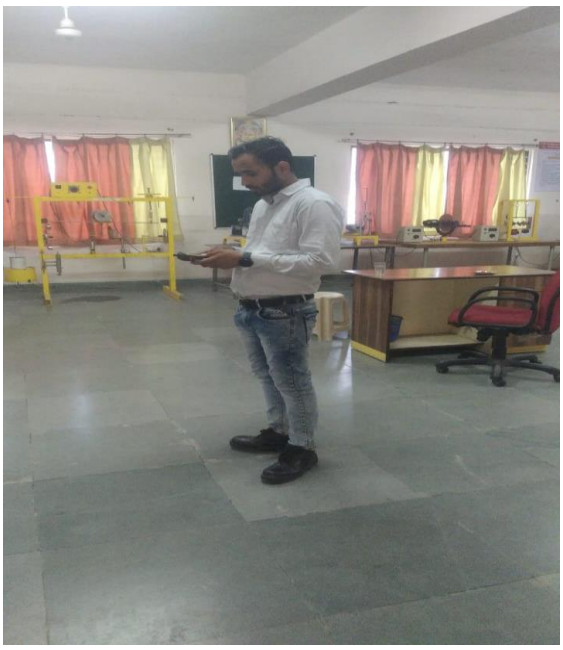
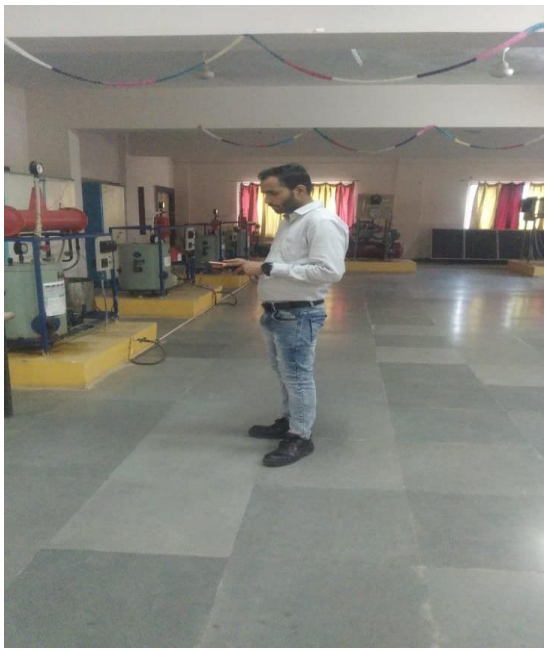



Fig.3.1 : Indoor Air Quality Monitoring

Observation:-

- $PM_{2.5}$ value is acceptable range. The 24-hour concentration of $PM_{2.5}$ is considered unhealthy when it rises above **35.4**µg/m^3
- PM_{10} value is an acceptable range. It should be below **155**µg/m^3
- CO_2 value is an acceptable range. It should be below 1000 ppm.

CHAPTER- 4
RAINWATER HARVESTING SYSTEM

4.1 Rainwater Harvesting systems

Rainwater harvesting is a technique to capture the rainwater when it precipitates, store that water for direct use or charge the groundwater and use it later.

There are typically four components in a rainwater harvesting system:

- Roof Catchment.
- Collection.
- Transport.
- Infiltration or storage tank and use.

If rainwater is not harvested and channelized it runoffs quickly and flows out through storm-water drains. For storm-water management, the recharge pits, percolation pits, and porous trenches are constructed to allow storm water to infiltrate inside the soil.

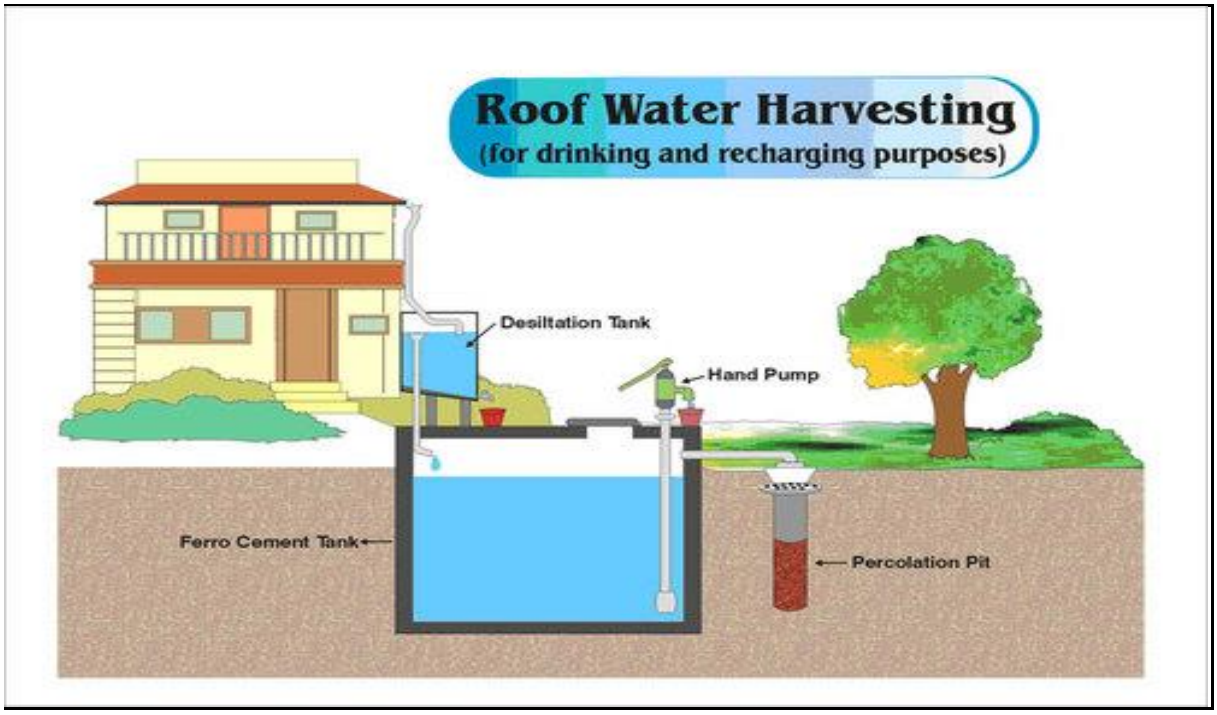


Fig. 4.1 Rain Water Harvesting structure

4.2 Rainwater Harvesting System in Institute

In institute (Excellence building) rain water harvesting is installed. **It's appreciable**

Figure: - 4.1 Rainwater harvesting in institute

END OF THE REPORT

THANKS

GREEN AUDIT REPORT

TECHNOCRATS INSTITUTE OF TECHNOLOGY (EXCELLENCE)

Anand Nagar, Opp. Hataikheda Dam, BHEL,
Bhopal, Madhya Pradesh - 462021

PREPARED BY

EMPIRICAL EXERGY PRIVATE LIMITED
Flat No. 201, OM Apartment, 214 Indrapuri Colony, Bhawarkuan,
Indore – 452 001 (M. P.), India 0731-4948831, 7869327256
Email ID:eempirical18@gmail.com
www.eeplgroups.com
(2021-23)

CONTENTS

ACKNOWLEDGEMENT

We would like to thank the **Technocrats Institute of Technology (Excellence), Bhopal (M.P.).** Our appreciation and gratitude to the management for granting us permission to conduct green audit for the institute

We are genuinely touched by the helpful attitudes and cooperation displayed by all the faculty members and technical staff involved in the audit. Their valuable assistance and cooperation significantly contributed to the successful execution of the audit.

For- Empirical Exergy Private Limited

Rajesh Kumar Singadiya

(Director)

M.Tech (Energy Management),
Accredited Energy Auditor [AEA-0284]
Certified Energy Auditor [CEA-7271]
(BEE, Ministry of Power, Govt. of India)
Empanelled Energy Auditor with MPUVN, Bhopal M.P.
Lead Auditor ISO50001:2011 [EnMS) from FICCI, Delhi
Certified Water Auditor (NPC, Govt. of India)
Chartered Engineer [M-1699118], The Institution of Engineers (India)
Member of ISHRAE [58150]

CERTIFICATE OF ACCREDITATION

ENERGY IS LIFE
BEE
CONSERVE IT

BUREAU OF ENERGY EFFICIENCY

Examination Registration No.: EA- 7271

Accreditation Registration No.: AEA-284

Certificate of Accreditation

This is to certify that Mr./Ms. Shri. Rajesh Kumar Singadiya having its trade/registered office at ..... has been given accreditation as accredited energy auditor. The certificate shall be effective from 9th day of May, 2018

The certificate is subject to the provisions of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

This certificate shall be valid until it is cancelled under regulation 9 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

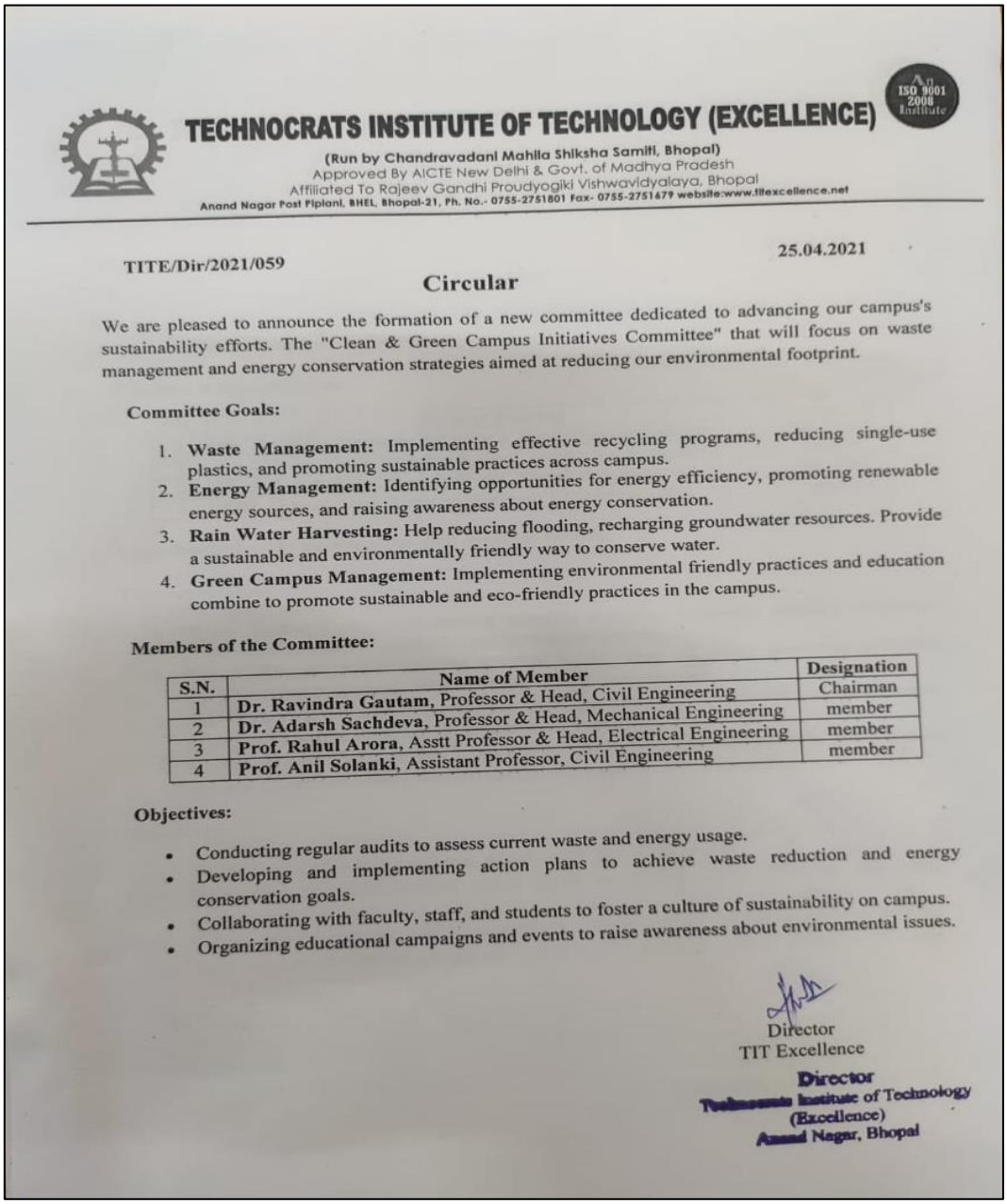
On cancellation, the certificate of accreditation shall be surrendered to the Bureau within fifteen days from the date of receipt of order of cancellation.

Your name has been entered at AEA No. 284 in the register of list of accredited energy auditors. Your name shall be liable to be struck out on the grounds specified in regulation 8 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

Given under the seal of the Bureau of Energy Efficiency, Ministry of Power, this 5th day of October, 2018

Secretary,
Bureau of Energy Efficiency
New Delhi

GREEN MONITORING COMMITTEE



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Approved By AICTE New Delhi & Govt. of Madhya Pradesh
Affiliated To Rajeev Gandhi Proudyogiki Vishwavidyalaya, Bhopal
Anand Nagar Post Piplani, BHEL, Bhopal-21, Ph. No.- 0755-2751801 Fax- 0755-2751679 website:www.titexcellence.net

TITE/Dir/2021/059 25.04.2021

Circular

We are pleased to announce the formation of a new committee dedicated to advancing our campus's sustainability efforts. The "Clean & Green Campus Initiatives Committee" that will focus on waste management and energy conservation strategies aimed at reducing our environmental footprint.

Committee Goals:

1. **Waste Management:** Implementing effective recycling programs, reducing single-use plastics, and promoting sustainable practices across campus.
2. **Energy Management:** Identifying opportunities for energy efficiency, promoting renewable energy sources, and raising awareness about energy conservation.
3. **Rain Water Harvesting:** Help reducing flooding, recharging groundwater resources. Provide a sustainable and environmentally friendly way to conserve water.
4. **Green Campus Management:** Implementing environmental friendly practices and education combine to promote sustainable and eco-friendly practices in the campus.

Members of the Committee:

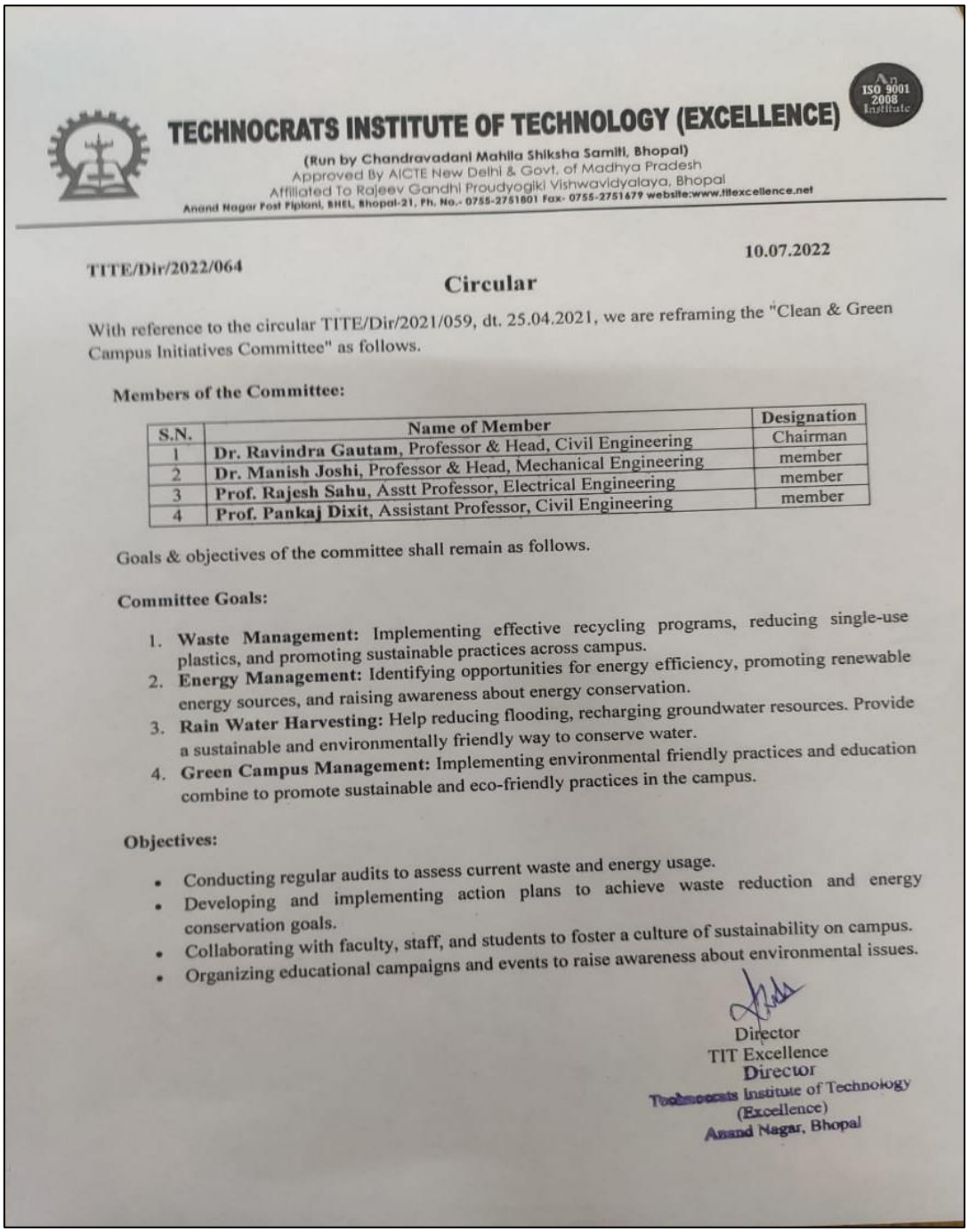
S.N.	Name of Member	Designation
1	**Dr. Ravindra Gautam**, Professor & Head, Civil Engineering	Chairman
2	**Dr. Adarsh Sachdeva**, Professor & Head, Mechanical Engineering	member
3	**Prof. Rahul Arora**, Asstt Professor & Head, Electrical Engineering	member
4	**Prof. Anil Solanki**, Assistant Professor, Civil Engineering	member

Objectives:

- Conducting regular audits to assess current waste and energy usage.
- Developing and implementing action plans to achieve waste reduction and energy conservation goals.
- Collaborating with faculty, staff, and students to foster a culture of sustainability on campus.
- Organizing educational campaigns and events to raise awareness about environmental issues.

Director
TIT Excellence

Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal



TECHNOCRATS INSTITUTE OF TECHNOLOGY (EXCELLENCE)

An ISO 9001 2008 Institute

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TITE/Dir/2022/064

10.07.2022

Circular

With reference to the circular TITE/Dir/2021/059, dt. 25.04.2021, we are reframing the "Clean & Green Campus Initiatives Committee" as follows.

Members of the Committee:

S.N.	Name of Member	Designation
1	**Dr. Ravindra Gautam**, Professor & Head, Civil Engineering	Chairman
2	**Dr. Manish Joshi**, Professor & Head, Mechanical Engineering	member
3	**Prof. Rajesh Sahu**, Asstt Professor, Electrical Engineering	member
4	**Prof. Pankaj Dixit**, Assistant Professor, Civil Engineering	member

Goals & objectives of the committee shall remain as follows.

Committee Goals:

1. **Waste Management:** Implementing effective recycling programs, reducing single-use plastics, and promoting sustainable practices across campus.
2. **Energy Management:** Identifying opportunities for energy efficiency, promoting renewable energy sources, and raising awareness about energy conservation.
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- Organizing educational campaigns and events to raise awareness about environmental issues.

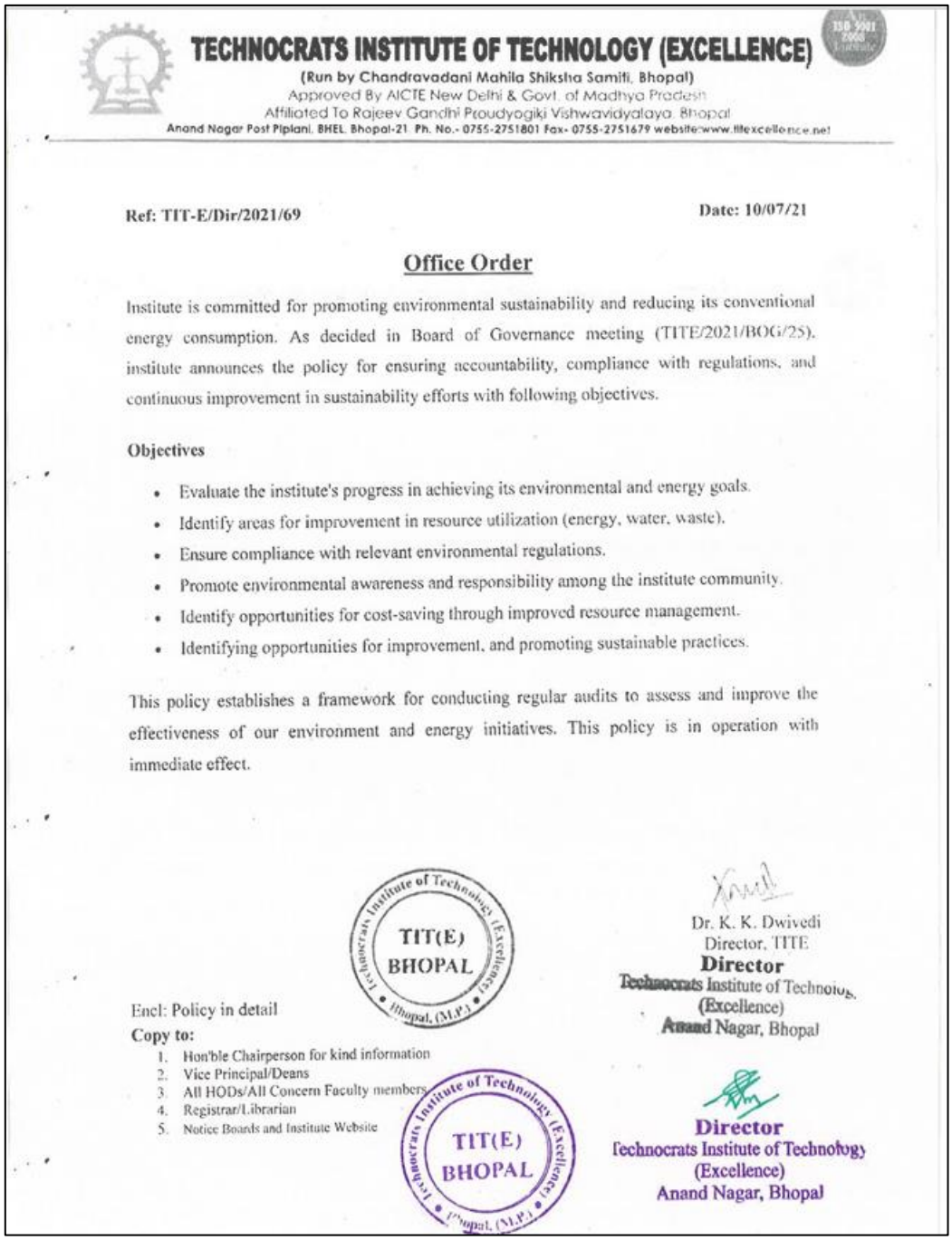
Director
TIT Excellence
Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

GREEN AUDIT TEAM

The audit team constituted by the following senior technical executives from the **Empirical Exergy Private Limited,**

- **Mr. Rajesh Kumar Singadiya**[Director & Accredited Energy Auditor AEA-0284]
- **Ms. Laxmi Raikwar** [Energy Expert and Report Reviewer]
- **Mr. Ajay Nahra** [Sr.Project Engineer]
- **Mr. Charchit Pathak** [Sr.Project Engineer]
- **Mr. Mohan Choudhary** [Electrical Engineer]
- **Mr. Praveen Punasiya** [Field Engineer]

ENERGY ENVIRONMENT POLICY



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Anand Nagar Post Piplani, BHEL Bhopal-21 Ph. No.- 0755-2751801 Fax- 0755-2751679 website:www.titexcellence.net

Ref: TIT-E/Dir/2021/69 Date: 10/07/21

Office Order

Institute is committed for promoting environmental sustainability and reducing its conventional energy consumption. As decided in Board of Governance meeting (TITE/2021/BOG/25), institute announces the policy for ensuring accountability, compliance with regulations, and continuous improvement in sustainability efforts with following objectives.

Objectives

- Evaluate the institute's progress in achieving its environmental and energy goals.
- Identify areas for improvement in resource utilization (energy, water, waste).
- Ensure compliance with relevant environmental regulations.
- Promote environmental awareness and responsibility among the institute community.
- Identify opportunities for cost-saving through improved resource management.
- Identifying opportunities for improvement, and promoting sustainable practices.

This policy establishes a framework for conducting regular audits to assess and improve the effectiveness of our environment and energy initiatives. This policy is in operation with immediate effect.

Technocrats Institute of Technology (Excellence) TIT(E) BHOPAL Bhopal (M.P.)

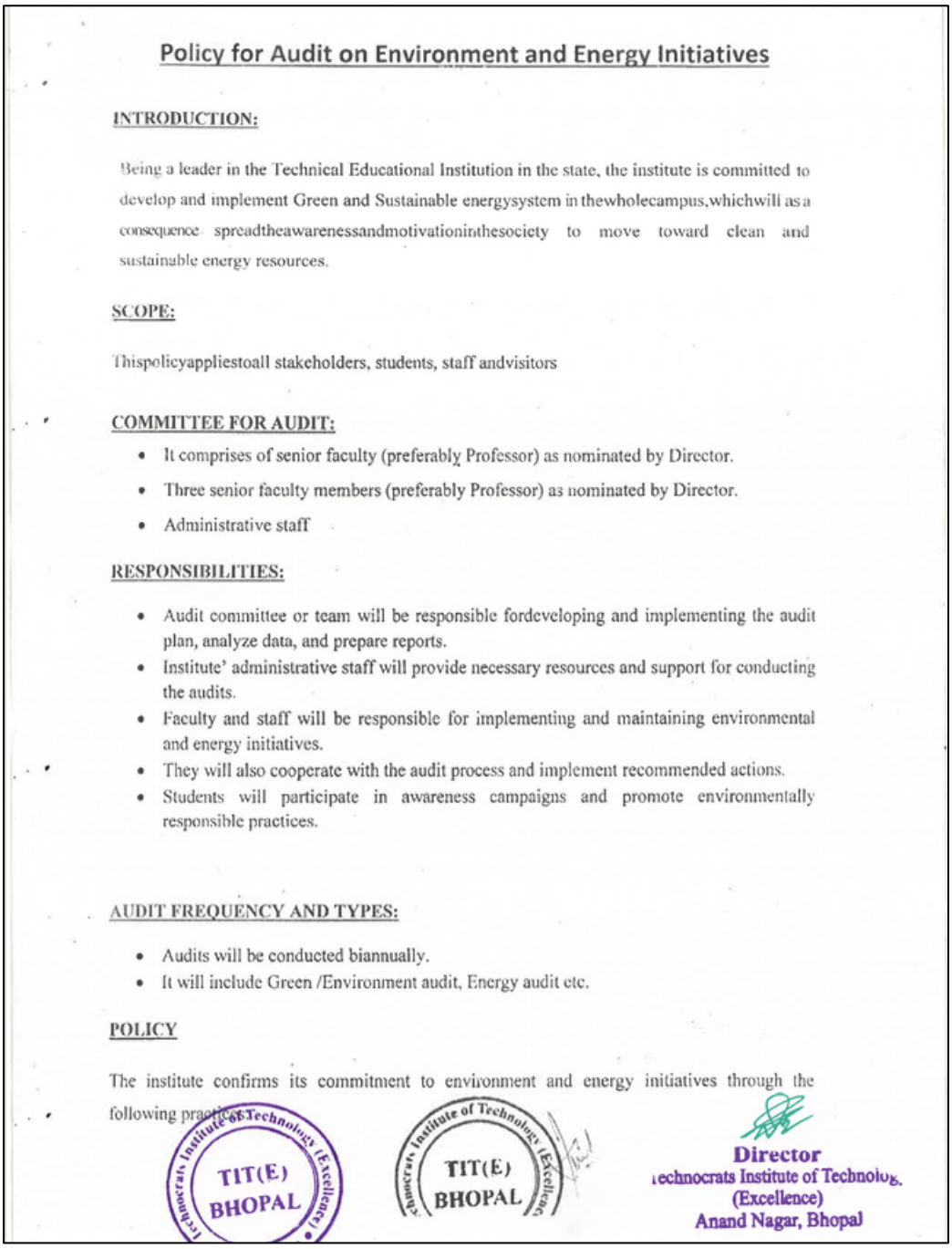
Dr. K. K. Dwivedi
Director, TITE
Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

Encl: Policy in detail

Copy to:
1. Hon'ble Chairperson for kind information
2. Vice Principal/Deans
3. All HODs/All Concern Faculty members
4. Registrar/Librarian
5. Notice Boards and Institute Website

Technocrats Institute of Technology (Excellence) TIT(E) BHOPAL Bhopal (M.P.)

Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal



Policy for Audit on Environment and Energy Initiatives

INTRODUCTION:

Being a leader in the Technical Educational Institution in the state, the institute is committed to develop and implement Green and Sustainable energysystem in thewholecampus,whichwill as a consequence spreadtheawarenessandmotivationinthesociety to move toward clean and sustainable energy resources.

SCOPE:

Thispolicyappliestoall stakeholders, students, staff andvisitors

COMMITTEE FOR AUDIT:

- It comprises of senior faculty (preferably Professor) as nominated by Director.
- Three senior faculty members (preferably Professor) as nominated by Director.
- Administrative staff

RESPONSIBILITIES:

- Audit committee or team will be responsible fordeveloping and implementing the audit plan, analyze data, and prepare reports.
- Institute' administrative staff will provide necessary resources and support for conducting the audits.
- Faculty and staff will be responsible for implementing and maintaining environmental and energy initiatives.
- They will also cooperate with the audit process and implement recommended actions.
- Students will participate in awareness campaigns and promote environmentally responsible practices.

AUDIT FREQUENCY AND TYPES:

- Audits will be conducted biannually.
- It will include Green /Environment audit, Energy audit etc.

POLICY

The institute confirms its commitment to environment and energy initiatives through the following practices.

TIT(E) BHOPAL

TIT(E) BHOPAL

Director
Technocrats Institute of Technology (Excellence)
Anand Nagar, Bhopal

1) Green audit / Environment audit
2) Energy audit
3) Clean and green campus initiatives
4) Beyond the campus environmental promotion activities

AUDIT DOCUMENTATION:

Audit committee

- Define outline requirements for documenting audit findings, conclusions, and recommendations.
- Define procedures for communicating audit results to relevant stakeholders, such as Institute' administration, faculty, and staff.
- Establish mechanisms for monitoring and tracking implementation of audit recommendations.

REVIEW

This policy will be reviewed and updated periodically if necessary to reflect changes in environmental regulations, best practices, and the Institute's evolving sustainability goals.

CONCLUSIONS:

By developing a comprehensive policy that addresses these aspects, the Institute effectively strives to continuously improve its environmental performance and contribute to a more sustainable future.

Dr. K. K. Dwivedi
Director, TITE
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

Discussed & finalized in meeting of Academic Council (TITE/2021/ACM/25) and submitted for information and approval in Board of Governance meeting.

Ms. Sadhna Karsoliya
Chairperson, TITE

Technocrats Institute of Technology (Excellence) TIT(E) BHOPAL Bhopal (M.P.)

Technocrats Institute of Technology (Excellence) TIT(E) BHOPAL Bhopal (M.P.)

Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

POLICY ON ENERGY AND WATER CONSERVATION

TECHNOCRATS INSTITUTE OF TECHNOLOGY (EXCELLENCE)
(Run by Chandravadani Mahila Shiksha Samiti, Bhopal)
Approved By AICTE New Delhi & Govt. of Madhya Pradesh
Affiliated To Rajeev Gandhi Proudyogiki Vishwavidyalaya, Bhopal
Anand Nagar Post Piplani, BHEL Bhopal-21, Ph. No.- 0755-2751801 Fax- 0755-2751679 website:www.tiexcellence.net

Ref: TIT-E/Dir/2021/68 Date: 09/07/21

Office Order

Institute is committed for energy conservation and fostering a culture of environmental responsibility among faculty, staff, and students. As decided in Board of Governance meeting (TITE/2021/BOG/25), institute announces the policy for ensuring energy conservation within the campus with following objectives.

Objectives

- Reduce overall energy consumption within the college.
- Promote the use of energy-efficient technologies and practices.
- Raise awareness about energy conservation through education and outreach programs.
- Continuously monitor and improve energy efficiency across the college.

The aim of this policy is to encourage and adopt practices that would lead to sustainable development, minimize carbon foot prints and depletion of natural resources and maximize recycling of resources. This policy is in operation with immediate effect.

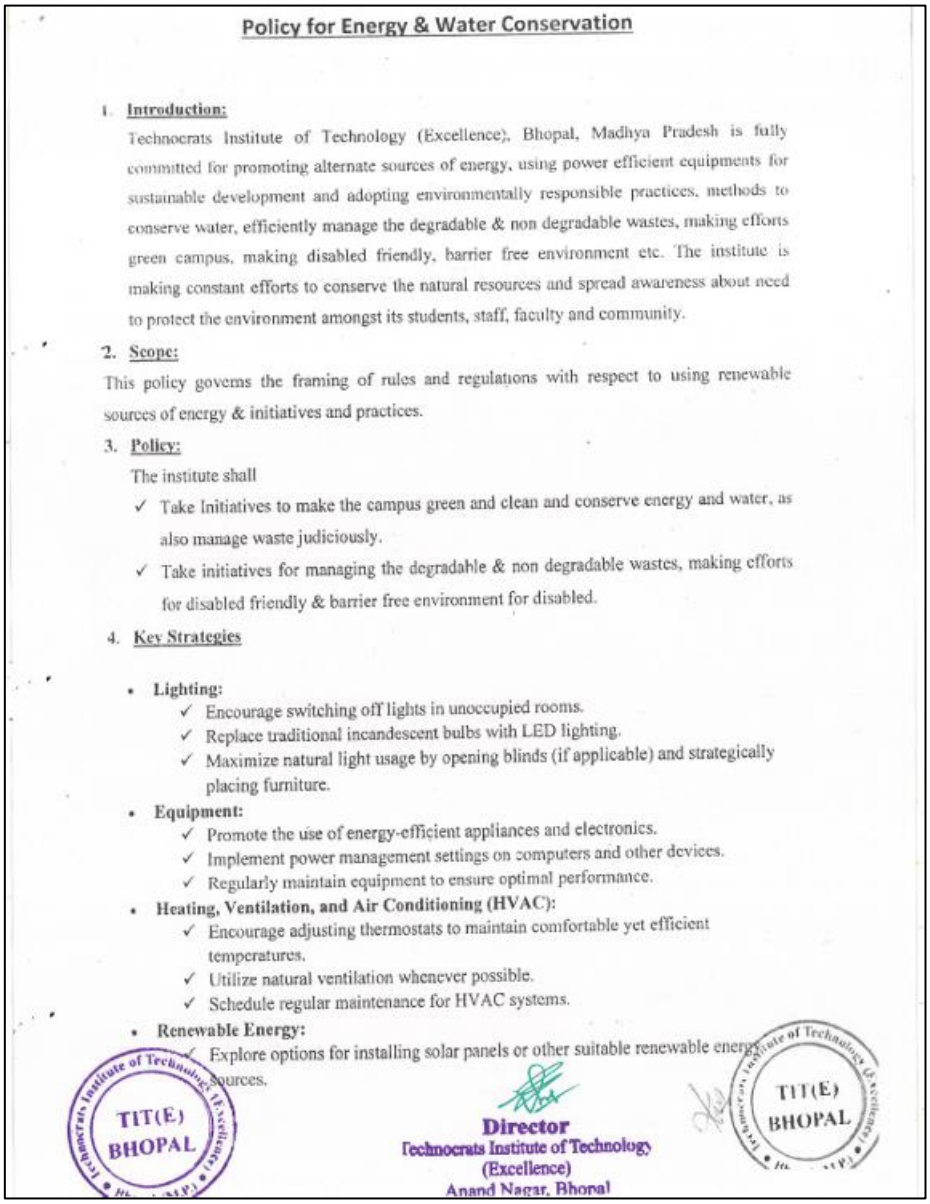
Dr. K. K. Dwivedi
Director, TITE
Director
Technocrats Institute of Technology (Excellence)
Anand Nagar, Bhopal

Encl: Policy in detail

Copy to:
1. Hon'ble Chairperson for kind information
2. Vice Principal/Deans/IQAC Coordinator
3. All HODs/All Concern Faculty members
4. Registrar/Librarian
5. Notice Boards and Institute Website

TIT(E) BHOPAL

Director
Technocrats Institute of Technology (Excellence)
Anand Nagar, Bhopal



Policy for Energy & Water Conservation

1. **Introduction:**

Technocrats Institute of Technology (Excellence), Bhopal, Madhya Pradesh is fully committed for promoting alternate sources of energy, using power efficient equipments for sustainable development and adopting environmentally responsible practices, methods to conserve water, efficiently manage the degradable & non degradable wastes, making efforts green campus, making disabled friendly, barrier free environment etc. The institute is making constant efforts to conserve the natural resources and spread awareness about need to protect the environment amongst its students, staff, faculty and community.

2. **Scope:**

This policy governs the framing of rules and regulations with respect to using renewable sources of energy & initiatives and practices.

3. **Policy:**

The institute shall

- ✓ Take Initiatives to make the campus green and clean and conserve energy and water, as also manage waste judiciously.
- ✓ Take initiatives for managing the degradable & non degradable wastes, making efforts for disabled friendly & barrier free environment for disabled.

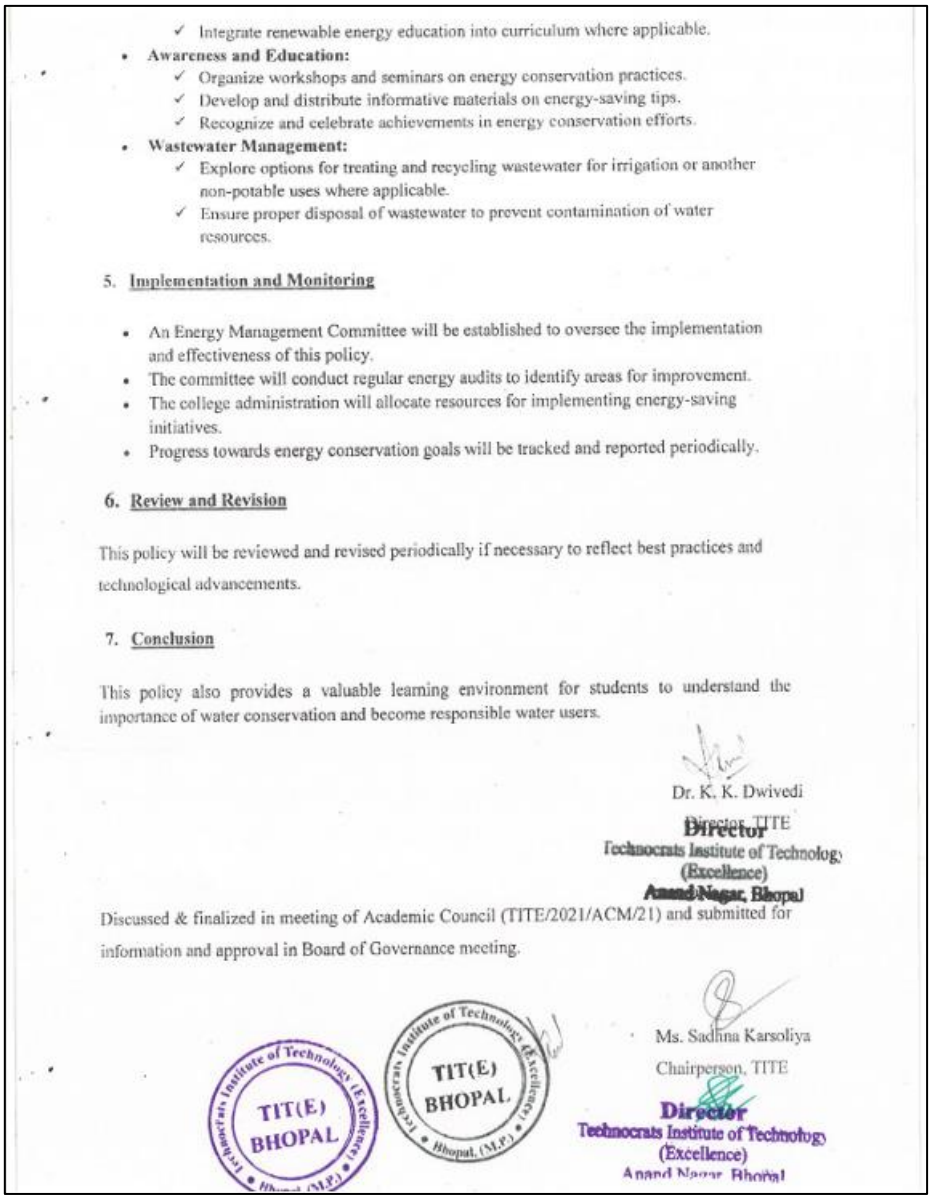
4. **Key Strategies**

- **Lighting:**
  - ✓ Encourage switching off lights in unoccupied rooms.
  - ✓ Replace traditional incandescent bulbs with LED lighting.
  - ✓ Maximize natural light usage by opening blinds (if applicable) and strategically placing furniture.
- **Equipment:**
  - ✓ Promote the use of energy-efficient appliances and electronics.
  - ✓ Implement power management settings on computers and other devices.
  - ✓ Regularly maintain equipment to ensure optimal performance.
- **Heating, Ventilation, and Air Conditioning (HVAC):**
  - ✓ Encourage adjusting thermostats to maintain comfortable yet efficient temperatures.
  - ✓ Utilize natural ventilation whenever possible.
  - ✓ Schedule regular maintenance for HVAC systems.
- **Renewable Energy:**
  - ✓ Explore options for installing solar panels or other suitable renewable energy sources.

TIT(E) BHOPAL

Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

TIT(E) BHOPAL



- ✓ Integrate renewable energy education into curriculum where applicable.

- **Awareness and Education:**
  - ✓ Organize workshops and seminars on energy conservation practices.
  - ✓ Develop and distribute informative materials on energy-saving tips.
  - ✓ Recognize and celebrate achievements in energy conservation efforts.
- **Wastewater Management:**
  - ✓ Explore options for treating and recycling wastewater for irrigation or another non-potable uses where applicable.
  - ✓ Ensure proper disposal of wastewater to prevent contamination of water resources.

5. **Implementation and Monitoring**

- An Energy Management Committee will be established to oversee the implementation and effectiveness of this policy.
- The committee will conduct regular energy audits to identify areas for improvement.
- The college administration will allocate resources for implementing energy-saving initiatives.
- Progress towards energy conservation goals will be tracked and reported periodically.

6. **Review and Revision**

This policy will be reviewed and revised periodically if necessary to reflect best practices and technological advancements.

7. **Conclusion**

This policy also provides a valuable learning environment for students to understand the importance of water conservation and become responsible water users.

Dr. K. K. Dwivedi
Director, TITE
Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

Discussed & finalized in meeting of Academic Council (TITE/2021/ACM/21) and submitted for information and approval in Board of Governance meeting.

Technocrats Institute of Technology (Excellence) TIT(E) BHOPAL Bhopal (M.P.)

Ms. Sadhna Karsoliya
Chairperson, TITE
Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

EXECUTIVE SUMMARY

The executive summary of the green audit report presented in this section briefly outlines the statistics of plants, trees in the campus, and carbon foot print status of the college.

GREEN INITIATIVES TAKEN BY COLLEGE

- **Campaign of Plantation And Green Campus**

  The college has around 8036 trees on campus. It is a good initiative taken by the management for creating a green campus under the plantation campaign. This effort is commendable.

- **E-vehicle System**

  The management has use E- vehicle in the campus for internal movement of staff and students. It's save nature resource as well as improved air quality of the campus. It is appreciable.

- **Solar System**

  The institute has 5 KWp solar energy off grid roof top system. It is appreciable.

GREEN AUDIT RECOMMENDATION

- **QR Code System on Tree**

  While the world seems to be going digital, people lack the time to read books and process the information they contain. Therefore, the college can provide QR codes on the trees to share information and leverage this rapidly growing platform for a unique purpose.

- **Installation Organic Waste Composting Machine**

  There is good potential for installation of organic waste composting machine to treat organic waste generated from trees and lawn area of the college campus. The output of above organic waste composting machine is good manure for garden and plants in the campus.

- **Five Dust bin System**

  It is observed that the college has adopted a two dustbin system for all kinds of waste generated on campus. It is recommended to implement a five-dustbin system for the segregation of different types of waste.

Chapter-1
INTRODUCTION

1.1 About Institute

Technocrats Institute of Technology (Excellence), Bhopal, is one of the premier institutes of Madhya Pradesh. This is an educational institute which is known in central India for imparting quality & value-based education for the past 12 years. This institute was started with a clear vision to develop the institute into a center of excellence in engineering education in the country with global standards. The institute is affiliated to Rajiv Gandhi Proudyogiki Vishwavidyalaya (RGPV), Bhopal for B.Tech, M.Tech , MCA programs & affiliated to Barkatullah University, Bhopal for MBA program. The institute is located in Anand Nagar, Raisen Road, Bhopal.

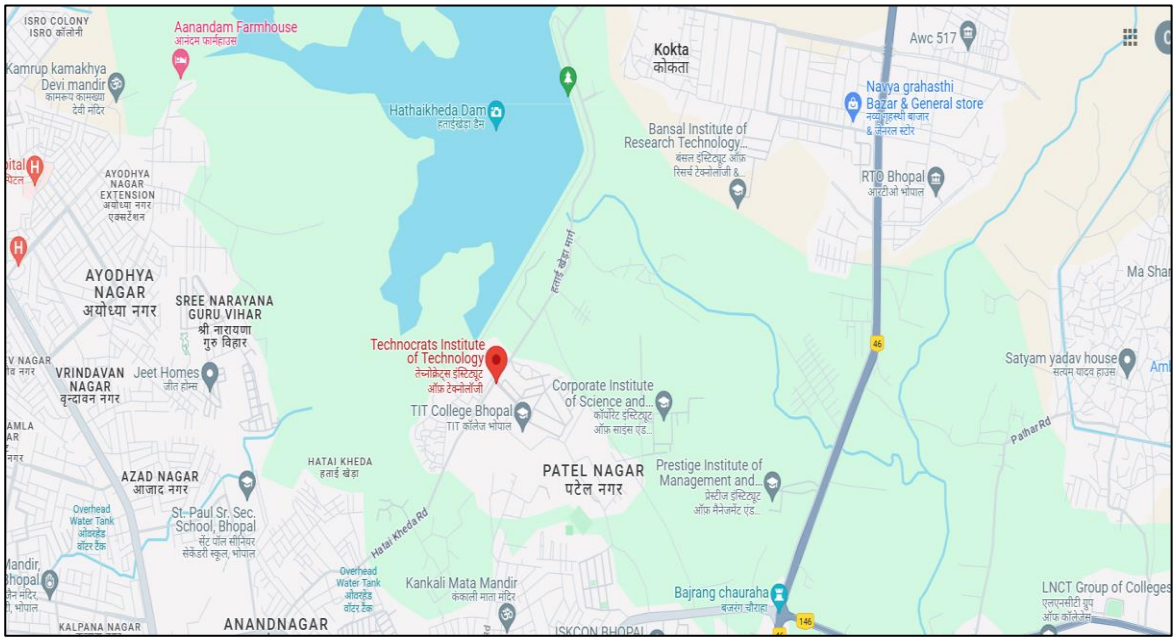


Figure 1.1: Source: Satellite Image of institute

The institute offers six courses at undergraduate level leading to bachelor's degree, B.Tech. in Electronics & Communication Engineering, Computer Science & Engineering, Civil Engineering, Electrical Engineering, Mechanical Engineering and CSE (Artificial Intelligence & Machine Learning) disciplines. Apart from these courses, institute also offers admissions in master's degree, M.Tech. in Computer Science & Engineering, Construction Technology & Management and CSE (Artificial Intelligence & Machine Learning), Master of Computer Application (MCA) & Master of Business Administration (MBA). Presently the total intake is 600 in UG courses and 450 in PG courses.

Vision of the Institute

To become a "Centre of Excellence" for quality education in the field of engineering, research and management so as to produce globally competent and socially responsible professionals, who can contribute in technological and socio-economic development of the nation as a whole and region in particular.

Mission of the Institute

M.1: To educate students with deep professional knowledge through innovative teaching-learning process and to make them aware of cutting edge technology so as to become capable of understanding and addressing the issues of society, state and the country.

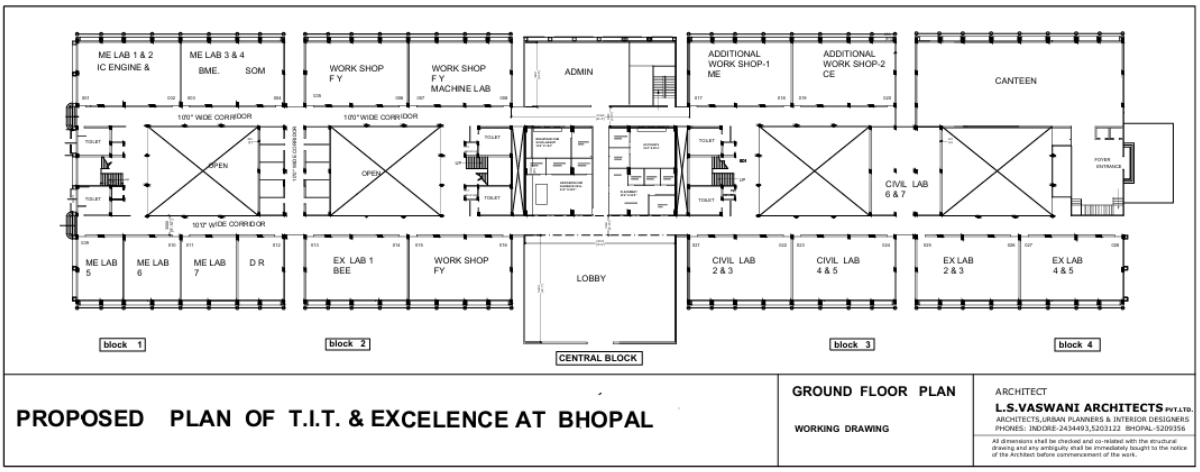
M.2: To create in- house facilities for research and innovation to provide solution to the industrial problems.

M.3: To inculcate right human values and professional ethics, leadership qualities, communication and entrepreneurship skills in students to meet the need of society.

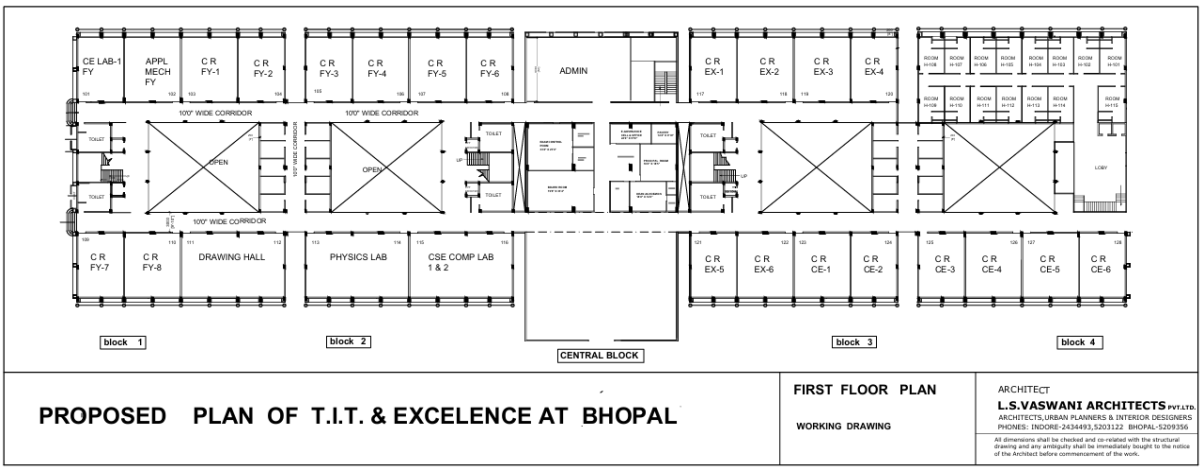
Institute Population

Sr. No.	Year	Teaching Staff (No.)	Non -Teaching Staff (No.)	Student (No.)
1	2020-21	212	98	2493
2	2021-22	212	98	2644
3	2022-23	213	98	2735

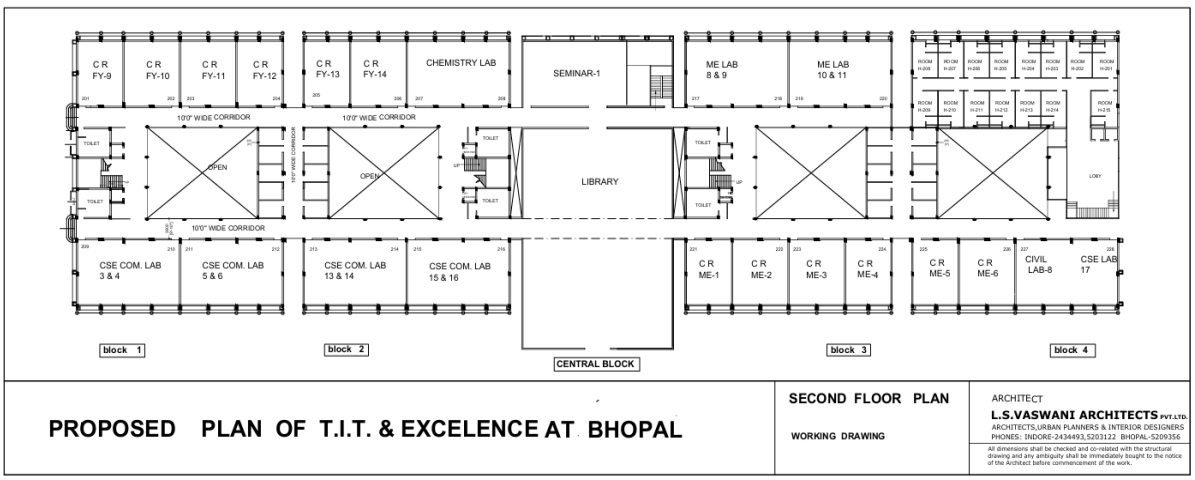
Institute Layout (Ground Floor Plan)



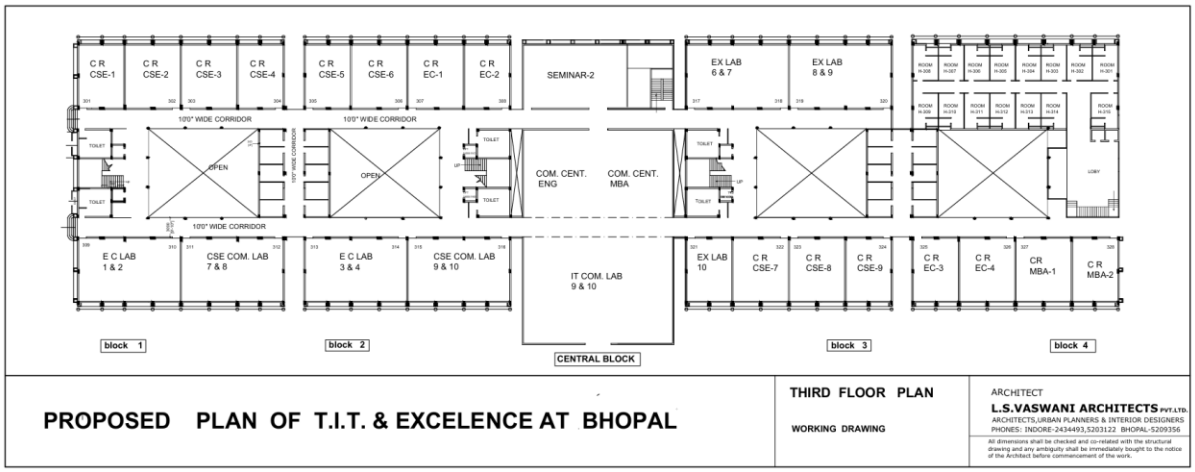
Institute Layout (First Floor Plan)



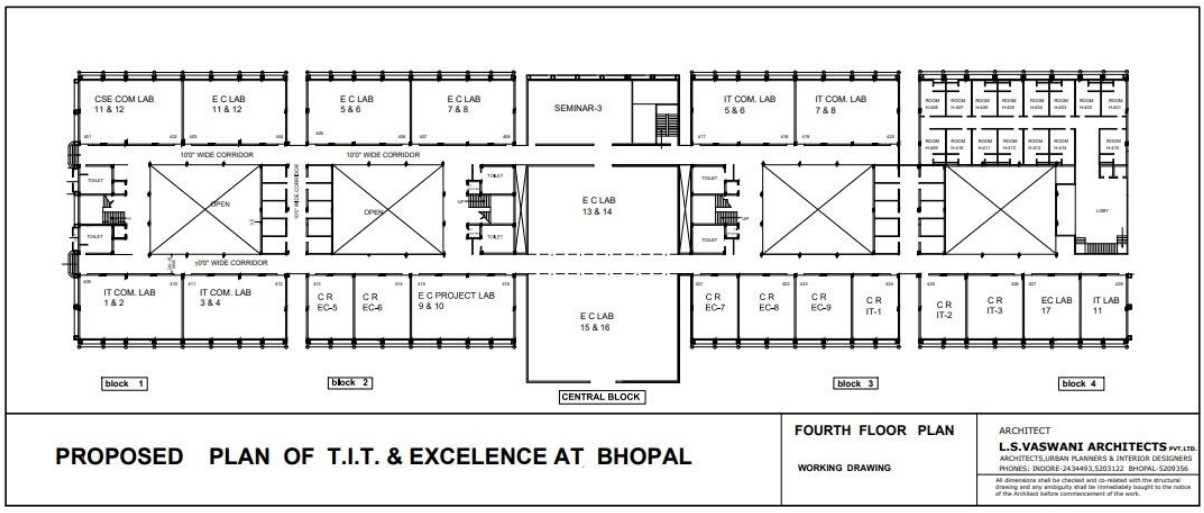
Institute Layout (Second Floor Plan)



Institute Layout (Third Floor Plan)



Institute Layout (Fourth Floor Plan)



1.2 About Green Audit

Eco campus is concepts implemented in many educational institutions, all over the world to make them sustainable because of their mass resource utilization and waste discharge in to the environment.

Green audit means to identify opportunities to sustainable development practices, enhance environmental quality, improve health, hygiene and safety, reduce liabilities achieve values of virtue. Green audit also provides a basis for calculating the economic benefits of resource conservation projects by establishing the current rates of resource use and their associated costs.

Green auditing of "**Technocrats Institute of Technology (Excellence), Bhopal (M.P.)**" enables to assess the life style, action and its impact on the environment. This green audit was mainly focused on greening indicators like utilisation of green energy (solar energy) and optimum use of secondary energy sources (petrol and diesel) in the Institute campus, vegetation, and carbon foot print of the campus etc. The aim of green auditing is to help the institution to apply sustainable development practices and to set examples before the community and young learners.

1.3 Objectives of Green Audit

The general objective of green audit is to prepare a baseline report on "Green campus" and alternative energy sources (solar energy), measures to mitigate resource wastage and improve sustainable practices.

The specific objectives are:

- To inculcate values of sustainable development practices through green audit mechanism.
- Providing a database for corrective actions and future plans.
- To identify the gap areas and suggest recommendations to improve the green campus status of the institutes.

CHAPTER- 2
GREEN CAMPUS AND SUSTAINABLE DEVELOPMENT

2.1 Green Audit

In the survey, the focus has been given to the assessment of the present status of plants and trees on the institute and efforts made by the management authorities for nature conservation. The campus is in the vicinity of approximately more than 8036 trees.

2.2 List of plants in Institute campus

Sr. no	Tree Name	Quantity (No's)
1	Areria	1000
2	Arekapama	800
3	Kanisa palam	200
4	Rechpama	300
5	Kundi pama	300
6	Caryota	200
7	Kutranjiva	30
8	Bgadi	2000
9	Varykate jasmine	2000
10	Gulab	100
11	Ficus	100
12	Fastalpama	6
13	Dracaena fragrans	500
14	Maritina	500
	Total	**8036**

Institute has **8036 trees** in the campus. This is good initiative taken by management for green campus under the campaign of plantation. **It's appreciable.**

CHAPTER-3
CARBON FOOT PRINT ASSESSMENT

3.1 About Carbon Foot Print.

Climate change is one of the greatest challenges facing nations, governments, institutions, business and mankind today.

Carbon footprint is a measure of the impact your activities have on the amount of carbon dioxide (CO_2) produced through the burning of fossil fuels and is expressed as a weight of CO_2 emissions produced in tones.

We focus on consumption in each of our five major categories: housing, travel, food, products and services. In addition to these we also estimate the share of national emissions over which we have little control, government purchases and capital investment.

For simplicity and clarity all our calculations follow one basic method. We multiply a use input by an emissions factor to calculate each footprint. All use inputs are per individual and include things like fuel use, distance, calorie consumption and expenditure. Working out your inputs is a matter of estimating them from your home, travel, diet and spending behaviour.

Although working out our inputs can take some investigation on your part the much more challenging aspect of carbon calculations is estimating the appropriate emissions factor to use in your calculation. Where possible you want this emissions factor to account for as much of the relevant life cycle as possible.

We all have a carbon footprint…

3.2 Methodology and Scope

The carbon footprint gives a general overview of the College greenhouse gas emissions, converted into CO_2 -equivalents and it is based on reported data from internal and external systems. The purposes of the carbon indicators are to measure the carbon intensity per unit of product, in addition to showing environmental transparency towards external stakeholders. The carbon footprint reporting approach undertaken in this study follows the guidelines and principles set out in the "Greenhouse Gas Protocol Corporate Accounting and Reporting Standard" (hereafter referred to as the GHG Protocol) developed by the Greenhouse Gas Protocol Initiative and international standard for the quantification and reporting of greenhouse gas emissions -ISO 14064. This is the most widely used and accepted methodology for conducting corporate carbon footprints. The study has assessed carbon emissions from the College Campus. This involves accounting for, and reporting on, the GHG emissions from all those activities for which the company is directly responsible. The items quantified in this study are as classified under the ISO 14064 standards: The report calculates the greenhouse gas emissions from the College. This includes electricity, as well as emission associated with diesel consumption in the College vehicle. The emission associated with air travel, waste generation, administration, and marketing related activities has been excluded from the current study. Emissions from business activities are generally classified as scope 1, 2 or 3 areas classified under the ISO 14064 standards.

3.3 Carbon emission from electricity

Direct emissions factors are widely published and show the amount of emissions produced by power stations in order to produce an average kilowatt-hour within that grid region

Unlike with other energy sources the carbon intensity of electricity varies greatly depending on how it is produced and transmitted. For most of us, the electricity we use comes from the grid and is produced from a wide variety of sources. Although working out the carbon intensity of this mix is difficult, most of the work is generally done for us.

Electricity used in the site is the significant contributors towards GHGs emission from the unit. Electricity used onsite is the most direct, and typically the most significant, a contributor to a unit's carbon footprint. Thus, using an average fuel mix of generating electricity, carbon dioxide intensity of electricity for national grid is assumed to be 0.9613 Kg CO_2/KWh

Table 3.1: Emission due to Electricity from Grid Unit

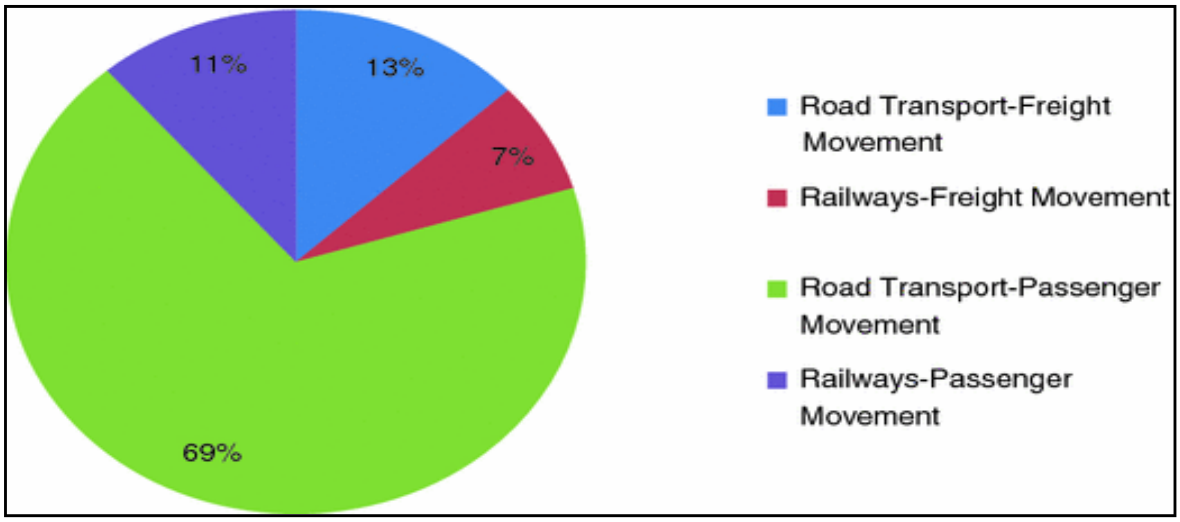
Sr.No.	Year	Total Unit Consumption	Unit	Emission Factor kg CO_2e/kWh	Emission ton CO_2e/ year
1	2021-22	3,90,751	kWh	0.9613	375.62
2	2022-23	4,99,663	kWh	0.9613	480.33

Table3.2: Emission due to Electricity from Solar Unit

Sr.No.	Year	Solar Unit	Unit	Emission Factor kg CO_2e/kWh	Emission reduction Ton CO_2e/ year
1	2021-22	7300	kWh	0.9613	7.01
2	2022-23	6388	kWh	0.9613	6.14

3.4 Carbon Emission from Vehicles

In India, it is the third most CO_2 emitting sector, and within the transport sector, road transport contributed more than 90% of total CO_2 emissions (IEA, 2020; Ministry of Environment Forest and Climate Change, 2018)



Transportation (29 percent of 2019 greenhouse gas emissions) – The transportation sector generates the largest share of greenhouse gas emissions. Greenhouse gas emissions from transportation primarily come from burning fossil fuels for our cars, trucks, ships, trains, and planes

We have also considered the total GHGs emission done by transportation facilities available on the campus like Cars, ambulances, Buses, etc. We consider the different types of vehicles which are operated on petrol and diesel fuels.

CO_2 Emission from vehicle

As per discussion by the concerned department in the institute and data provided by management. The following details are given in the table:

Table 3.3: Distance travelled and Diesel Consumption of Vehicle

Sr. No.	Year	Distance Travelled Per Month (K.M.)	Diesel Consumption (Lit.)
1	2021-22	2,62,500	57692
2	2022-23	2,84,375	62500

$$\text{Total } CO_2 \text{ Emissions} = \frac{CO_2 \text{ Per liter}}{\text{Average Mileage (Km/Liter)}} \times \text{Distance (in km)}$$

- CO_2 Emissions from a Littre of Diesel: 2689.56 grams CO_2/ litre.
- CO_2 Emissions Year 2021-22= (2689.56/4.5) X 2, 62,500 = 155.15 ton/year
- CO_2 Emissions Year 2022-23= (2689.56/4.55) X 2, 84,375 = 168.10 ton/year

CO_2 Emission from LPG (gas cylinder)

- CO_2 Emissions from kg of LPG: 3.01 CO_2/ kg of LPG.
- LPG Cylinder Consumption Year 2021-22= 20 No *12 *19 Kg/ Cylinder = 4560Kg
- CO_2 Emissions Year 2021-22= 4560x 3.01 = 13.72 Ton/year
- LPG Cylinder Consumption Year 2021-22= 25 No *12 *19 Kg/ Cylinder =5700 Kg
- CO_2 Emissions Year 2022-23= 5700x 3.01 = 17.15 Ton/year

3.5 Carbon emission from DG set

The institute has one DG set use for emergency power supply. Annual diesel consumption for year 2021-22 was 1270 and for the year 2022-23 was 830 lit.

- CO_2 Emissions from a Lit.of diesel: 2689.56 grams CO_2/ lit.
- Diesel consumption Year 2021-22 = 1270 Lit.
- Diesel consumption Year 2021-22 = 1270 x 2689 = 3.41 Ton /Year
- Diesel consumption Year 2022-23 = 830 Lit.
- Diesel consumption Year 2022-23 = 830 x 2689 = 2.23 Ton /Year

3.6 Biomass Calculation and CO_2 Sequestration of the Trees

1. Estimation of above-ground biomass (AGB)

$$K= 34.4703 – 8.0671D + 0.6589 D^2$$

Where = K is above-ground biomass.

D is Breast height diameter in (cm)

2. Estimation of below ground biomass (BGD) = AGB x 0.15

3. Total Biomass (TB) = AGB + BGB

4. Calculation of carbon dioxide Weight sequestered in the tree in Kg.

$$C = W \times 0.50$$

5. Calculation the weight of CO_2 sequestered in the tree per year in Kg.

$$CO_2 = C \times 3.666$$

Where: -

AGB = above ground biomass.
D = Diameter of tree breast height.
BGB = Below Ground Biomass.
C = Carbon
TB = Total Biomass.

Table: 3.4 CO_2 Sequestered Calculation of tree (Year 2021-22)

Sr. no.	Tree Name	Average Diameter CM (10 to 100)	AGB	BGB	Total	Carbon Storage	Amount of CO_2 Sequestered	Total	Total Amount of CO_2 Sequestered	Annually CO_2 Sequestered amount (Ton/year)
1	Areria	52	1450.7	217.6	1668.3	834.2	3058.1	800	2446456	33.37
2	Arekapama	28	340.9	51.1	392.0	196.0	718.5	760	546059	7.45
3	Kanisa palam	60	1994.5	299.2	2293.7	1146.8	4204.3	200	840857	11.47
4	Rechpama	35	583.8	87.6	671.3	335.7	1230.6	300	369172	5.04
5	Kundi pama	62	2144.0	321.6	2465.6	1232.8	4519.5	300	1355838	18.49
6	Caryota	44	993.9	149.1	1143.0	571.5	2095.0	150	314255	4.29
7	Kutranjiva	40	798.0	119.7	917.7	458.9	1682.2	30	50466	0.69
8	Bgadi	80	3734.1	560.1	4294.2	2147.1	7871.2	2000	15742466	214.71
9	Varykate jasmine	38	708.3	106.2	814.5	407.2	1493.0	2000	2985935	40.72
10	Gulab	10	21.7	3.3	24.9	12.5	45.7	80	3658	0.05
11	Ficus	60	1994.5	299.2	2293.7	1146.8	4204.3	100	420429	5.73
12	Fastalpama	54	1578.5	236.8	1815.3	907.7	3327.5	6	19965	0.27
13	Dracaena fragrans	12	35.4	5.3	40.7	20.4	74.7	490	36593	0.50
14	Maritina	48	1211.4	181.7	1393.2	696.6	2553.7	500	1276827	17.41
										360.19

- Institute has 7716 trees on campus. This is a good initiative taken by management for a green campus under the campaign of the plantation. It'sappreciable. There are total CO_2 sequestered of 360.19 Tons /Year. It's appreciable.

Table 3.5: CO_2 Sequestered Calculation of tree (Year 2022-23)

Sr. no.	Tree Name	Average Diameter CM (10 to 100)	AGB	BGB	Total	Carbon Storage	Amount of CO_2 Sequestered	Total	Total Amount of CO_2 Sequestered	Annually CO_2 Sequestered amount (Ton/year)
1	Areria	52	1450.7	217.6	1668.3	834.2	3058.1	1000	3058070	41.71
2	Arekapama	28	340.9	51.1	392.0	196.0	718.5	800	574799	7.84
3	Kanisa palam	60	1994.5	299.2	2293.7	1146.8	4204.3	200	840857	11.47
4	Rechpama	35	583.8	87.6	671.3	335.7	1230.6	300	369172	5.04
5	Kundi pama	62	2144.0	321.6	2465.6	1232.8	4519.5	300	1355838	18.49
6	Caryota	44	993.9	149.1	1143.0	571.5	2095.0	200	419007	5.71
7	Kutranjiva	40	798.0	119.7	917.7	458.9	1682.2	30	50466	0.69
8	Bgadi	80	3734.1	560.1	4294.2	2147.1	7871.2	2000	15742466	214.71
9	Varykate jasmine	38	708.3	106.2	814.5	407.2	1493.0	2000	2985935	40.72
10	Gulab	10	21.7	3.3	24.9	12.5	45.7	100	4572	0.06
11	Ficus	60	1994.5	299.2	2293.7	1146.8	4204.3	100	420429	5.73
12	Fastalpama	54	1578.5	236.8	1815.3	907.7	3327.5	6	19965	0.27
13	Dracaena fragrans	12	35.4	5.3	40.7	20.4	74.7	500	37340	0.51
14	Maritina	48	1211.4	181.7	1393.2	696.6	2553.7	500	1276827	17.41
Total CO_2 Emission neutralize by the trees										370.37

- Institute has 8036 trees on campus. This is a good initiative taken by management for a green campus under the campaign of the plantation. It'sappreciable. There are total CO_2 sequestered of 370.37 Tons /Year. It's appreciable.

Table 3.6: Total CO_2 Emission by the Institute

Sr. No.	CO_2 (Emission & Neutralized) Sources	CO_2 Emission Ton/year (2021-22)	CO_2 Emission Ton/year (2022-23)
1	Electricity	375.62	480.33
2	Vehicle	155.15	168.1
3	LPG Cylinder	13.72	17.15
4	DG set Diesel	3.41	2.23
5	Total CO_2 Emission	547.9	667.81
6	CO_2Emission Neutralized by Tree	360.19	370.37
7	CO_2 Emission Neutralized by Solar	7.01	6.14
8	Net CO_2 Emission of the Institute	180.80	291.3

Observation:

- Net CO_2 Emission of the Institute is increase of the organization

3.7 Other Emissions Excluded

This study did not evaluate the carbon sequestration potential of existing from the staff commuting, food supply, official flights, paper products, water supply, and waste disposal and recycling due to limited data availability. The current study identifies areas where data monitoring, recording and archiving need to be developed for enlarging the scope of mapping of GHGs emission in the future years. Accordingly, a set of tools and record keeping procedure will be developed for improving the quality of data collection for the next year carbon foot print studies.

CHAPTER- 4
WASTE MANAGEMENT

4.1 About Waste

Human activities create waste, and it is the way these wastes are handled, stored, collected and disposed of, which can pose risks to the environment and to public health waste management is important for an eco-friendly campus. In College different types of wastes are generated, its collection and management are very challenging.

Solid waste can be divided into three categories: bio-degradable, non-biodegradable and hazardous waste. A bio-degradable waste includes food wastes, canteen waste, wastes from toilets etc. Non-biodegradable wastes include what is usually thrown away in homes and schools such as plastic, tins and glass bottles etc. Hazardous waste is waste that is likely to be a threat to health or the environment like cleaning chemicals, acids and petrol.

Unscientific management of these wastes such as dumping in pits or burning them may cause harmful discharge of contaminants into soil and water supplies, and produce greenhouse gases contributing to global climate change respectively. Special attention should be given to the handling and management of hazardous waste generated in the College. Bio-degradable waste can be effectively utilized for energy generation purposes through anaerobic digestion or can be converted to fertilizer by composting technology. Non-biodegradable waste can be utilized through recycling and reuse. Thus, the minimization of solid waste is essential to a sustainable College. The auditor diagnoses the prevailing waste disposal policies and suggests the best way to combat the problems.

Table 4.1 Different types of waste generated in the College Campus.

Sr.No.	Types of Waste	Particulars
1	Solid wastes	Damaged furniture, paper waste, paper plates, food wastes etc.
2	Plastic waste	Pen, Refill, Plastic water bottles and other plastic containers, wrappers etc.
3	E-Waste	Computers, electrical and electronic parts etc.
4	Glass waste	Broken glass wares from the labs etc.
5	Chemical wastes	Laboratory waste etc.
6	Bio-medical Waste	Sanitary Napkin etc.

4.2 Waste management Practices adopted by the Institute

Audit team visited various departments, classroom and other areas, to find out waste generation area and waste collection points for further improvement. Details are given in the table.

Figure 4.1 Waste collection bin in Institute campus

Recommendation

It is recommended adopted **"5 Bin Waste Collection System"** for collect different type of waste generated in Institute premises. At present institute uses 3 dustbin system.

Fig. 4.2 Recommended 5 Dust Bin waste collection System

4.3 Waste Collection Points

Audit team visited various departments, class rooms, staff rooms, laboratories to find out waste generation area and waste collection points for further improvement. Details are given in the table 4.2

Table 4.2: Detailed of Waste collection Dust bin system

Sr.no.	Location	No. of dustbins
1	A-block	29
2	B-block	25
3	C-block	27
	Total	**81**

Observation:

It was observed that institute has 2 dustbin System. There is 81 no of dustbins placed at different location in A,B and C block.

4.4 Vermi-compost Pit:

The institute has compost pit, all types of agriculture and organic waste will be disposed of in this pit, and generated manure will utilized in plant and trees in the campus. It's appreciable.

Figure 4.3 Compost pit in the institute campus

4.5 Organic Waste Composting Machine

The audit team visited in various department and garden and discussion with the management the waste collection process. After audit we recommended for organic waste composting machine for college per day waste generated.

Fig.4.4 Organic Waste composting machine

About Composting Process

An organic waste composting machine is an independent unit that facilitates the composting process and provides better compost. It takes waste as its input and provides manure as its output. Composting without an organic waste composting machine will take a considerable amount of time.

Highly compact composting machine, which uses special microorganisms to break down and decompose all kinds of organic waste into compost within 24 hrs with a volume reduction of 85-90%. When organic waste is added to it, moisture is sensed by the humidity sensor, heater, mixing blades, and an exhaust system.

Recommendation

College has a good potential to install an organic waste composting machine

CHAPTER- 5
QR CODE SYSTEM

5.1 QR Code System

While the world seems to be going digital, people lack the time to read books and process the information they contain. Hence, College can be provided QR codes on the trees for its information and to exploit the rapidly growing platform for a unique purpose.

Fig: 6.1 QR Code System for plants

These codes can give students all the information they need to know about the tree — from its scientific name to its medicinal value. They only need to put their smart-phones to use. QR codes to them, making it easier for everybody to learn about a plant or a tree at the tip of their fingers," If any app generating a QR code, which is available for free on the online stores, can be used to avail the information of the trees.

❖ **Eco-restoration programmes**

- Frame long-term eco-restoration programmes for replacing exotic Acacia plantations with indigenous trees and need of the hour is to frame a holistic campus development plan.

END OF THE REPORT

THANKS

ENERGY AUDIT REPORT

TECHNOCRATS INSTITUTE OF TECHNOLOGY (EXCELLENCE)

Anand Nagar, Opp. Hataikheda Dam, BHEL,
Bhopal, Madhya Pradesh - 462021

PREPARED BY

EMPIRICAL EXERGY PRIVATE LIMITED
Flat No. 201, OM Apartment, 214 Indrapuri Colony, Bhawarkuan,
Indore – 452 001 (M. P.), India 0731-4948831, 7869327256
Email ID:eempirical18@gmail.com
www.eeplgroups.com

(2021-23)

CONTENTS

ACKNOWLEDGEMENT

We would like to thank the **Technocrats Institute of Technology (Excellence), Bhopal (M.P.).** Our appreciation and gratitude to the management for granting us permission to conduct energy audit for the institute

We are genuinely touched by the helpful attitudes and cooperation displayed by all the faculty members and technical staff involved in the audit. Their valuable assistance and cooperation significantly contributed to the successful execution of the audit.

For- Empirical Exergy Private Limited

Rajesh Kumar Singadiya

(Director)

M.Tech (Energy Management),
Accredited Energy Auditor [AEA-0284]
Certified Energy Auditor [CEA-7271]
(BEE, Ministry of Power, Govt. of India)
Empanelled Energy Auditor with MPUVN, Bhopal M.P.
Lead Auditor ISO50001:2011 [EnMS) from FICCI, Delhi
Certified Water Auditor (NPC, Govt. of India)
Chartered Engineer [M-1699118], The Institution of Engineers (India)
Member of ISHRAE [58150]

CERTIFICATE OF ACCREDITATION

ENERGY IS LIFE
BEE
CONSERVE IT

BUREAU OF ENERGY EFFICIENCY

Examination Registration No.: EA- 7271
Accreditation Registration No.: AEA-284

Certificate of Accreditation

This is to certify that Mr./Ms. Shri. Rajesh Kumar Singadiya having its trade/registered office at ..... has been given accreditation as accredited energy auditor. The certificate shall be effective from 9th day of May, 2018

The certificate is subject to the provisions of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

This certificate shall be valid until it is cancelled under regulation 9 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

On cancellation, the certificate of accreditation shall be surrendered to the Bureau within fifteen days from the date of receipt of order of cancellation.

Your name has been entered at AEA No. 284 in the register of list of accredited energy auditors. Your name shall be liable to be struck out on the grounds specified in regulation 8 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010.

Given under the seal of the Bureau of Energy Efficiency, Ministry of Power, this 5th day of October, 2018

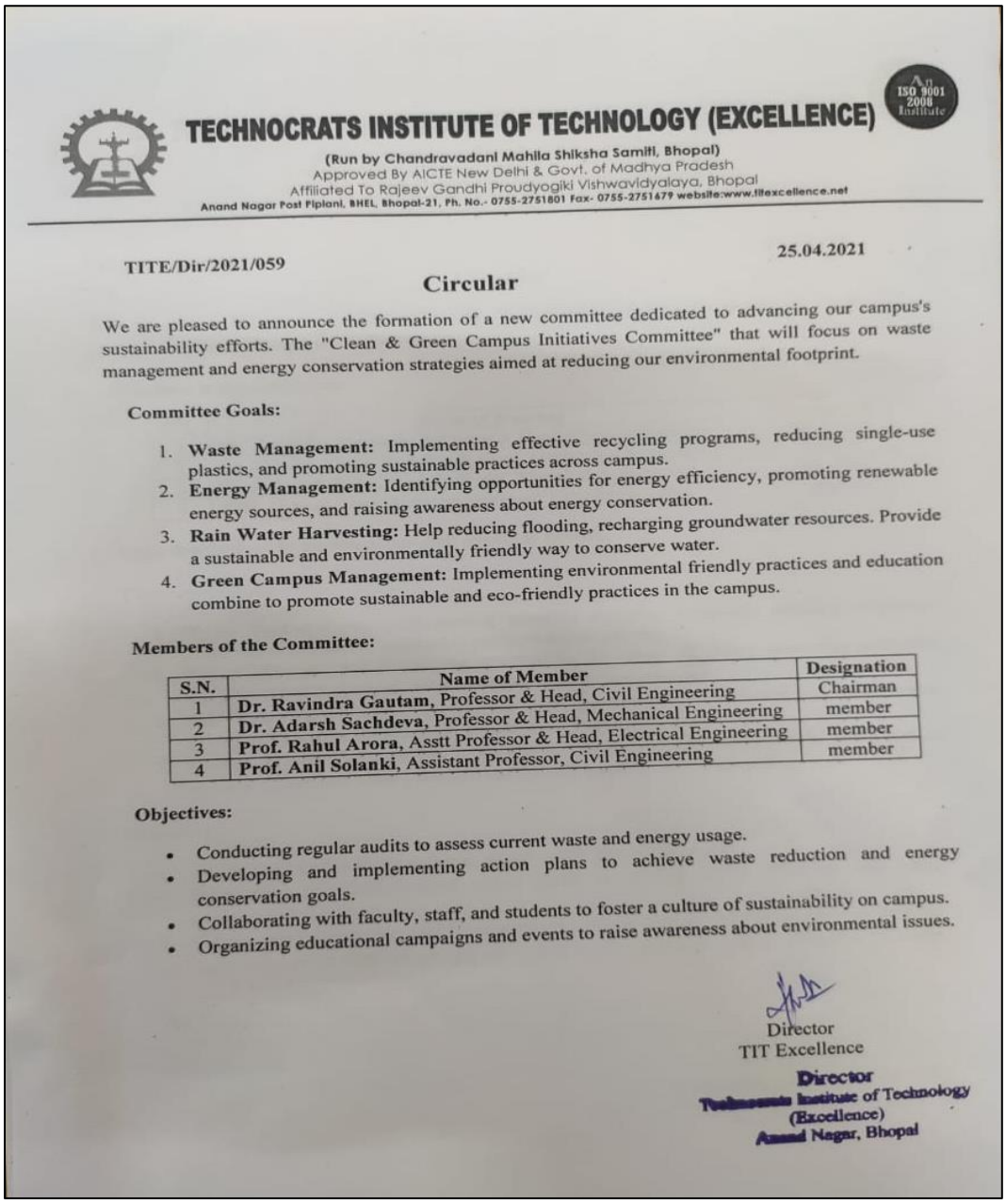
Secretary,
Bureau of Energy Efficiency
New Delhi

ENERGY AUDIT TEAM

The audit team constituted by the following senior technical executives from the **Empirical Exergy Private Limited,**

- **Mr. Rajesh Kumar Singadiya**[Director & Accredited Energy Auditor AEA-0284]
- **Ms. Laxmi Raikwar** [Energy Expert and Report Reviewer]
- **Mr. Ajay Nahra** [Sr.Project Engineer]
- **Mr. Charchit Pathak** [Sr.Project Engineer]
- **Mr. Mohan Choudhary** [Electrical Engineer]
- **Mr. Praveen Punasiya** [Field Engineer]

ENERGY MONITORING COMMITTEE



TECHNOCRATS INSTITUTE OF TECHNOLOGY (EXCELLENCE)

An ISO 9001 2008 Institute

(Run by Chandravadani Mahila Shiksha Samiti, Bhopal)
Approved By AICTE New Delhi & Govt. of Madhya Pradesh
Affiliated To Rajeev Gandhi Proudyogiki Vishwavidyalaya, Bhopal
Anand Nagar Post Piplani, BHEL, Bhopal-21, Ph. No.- 0755-2751801 Fax- 0755-2751479 website:www.titexcellence.net

TITE/Dir/2021/059 25.04.2021

Circular

We are pleased to announce the formation of a new committee dedicated to advancing our campus's sustainability efforts. The "Clean & Green Campus Initiatives Committee" that will focus on waste management and energy conservation strategies aimed at reducing our environmental footprint.

Committee Goals:

1. **Waste Management:** Implementing effective recycling programs, reducing single-use plastics, and promoting sustainable practices across campus.
2. **Energy Management:** Identifying opportunities for energy efficiency, promoting renewable energy sources, and raising awareness about energy conservation.
3. **Rain Water Harvesting:** Help reducing flooding, recharging groundwater resources. Provide a sustainable and environmentally friendly way to conserve water.
4. **Green Campus Management:** Implementing environmental friendly practices and education combine to promote sustainable and eco-friendly practices in the campus.

Members of the Committee:

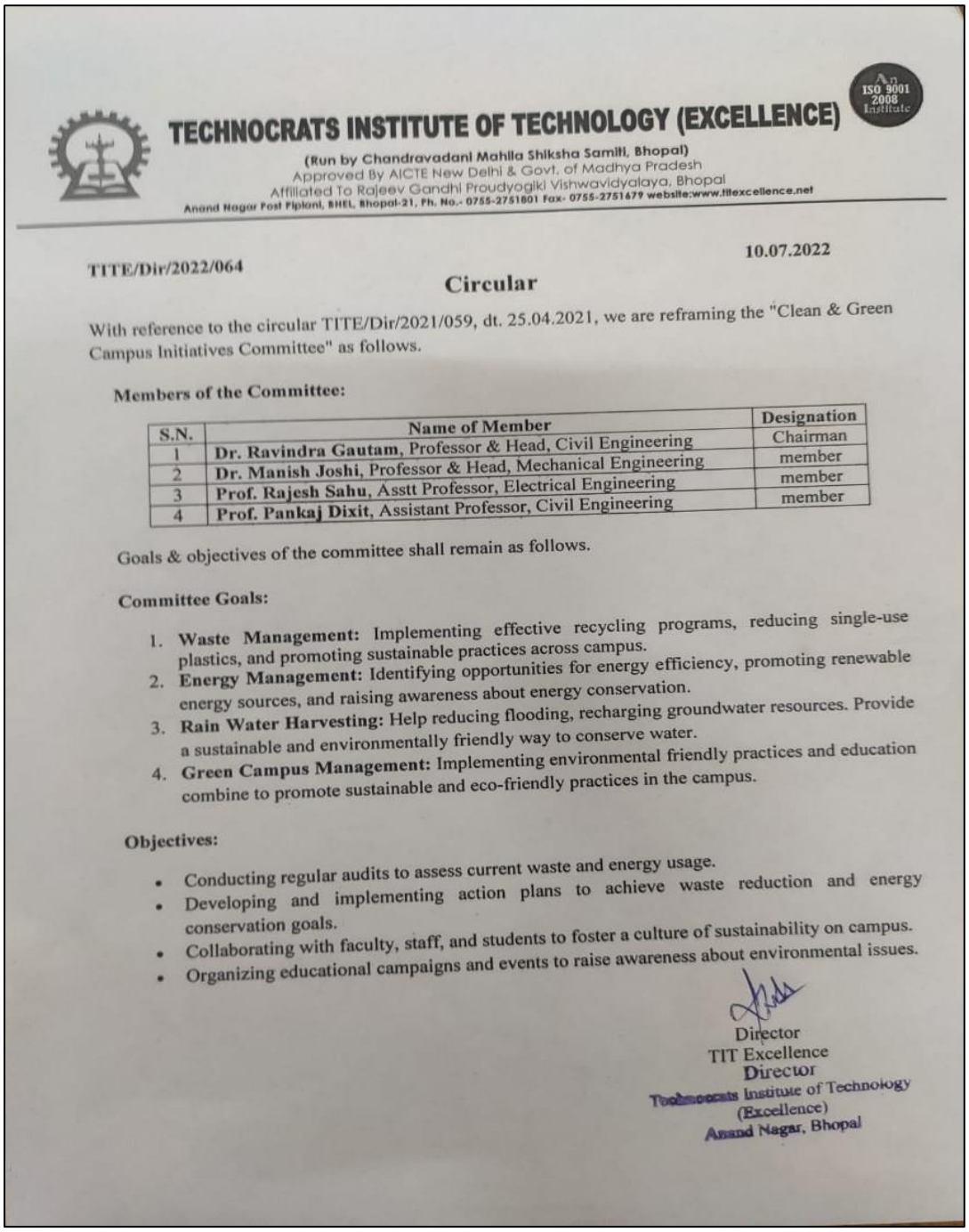
S.N.	Name of Member	Designation
1	**Dr. Ravindra Gautam**, Professor & Head, Civil Engineering	Chairman
2	**Dr. Adarsh Sachdeva**, Professor & Head, Mechanical Engineering	member
3	**Prof. Rahul Arora**, Asstt Professor & Head, Electrical Engineering	member
4	**Prof. Anil Solanki**, Assistant Professor, Civil Engineering	member

Objectives:

- Conducting regular audits to assess current waste and energy usage.
- Developing and implementing action plans to achieve waste reduction and energy conservation goals.
- Collaborating with faculty, staff, and students to foster a culture of sustainability on campus.
- Organizing educational campaigns and events to raise awareness about environmental issues.

Director
TIT Excellence

Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal



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TITE/Dir/2022/064

10.07.2022

Circular

With reference to the circular TITE/Dir/2021/059, dt. 25.04.2021, we are reframing the "Clean & Green Campus Initiatives Committee" as follows.

Members of the Committee:

S.N.	Name of Member	Designation
1	**Dr. Ravindra Gautam**, Professor & Head, Civil Engineering	Chairman
2	**Dr. Manish Joshi**, Professor & Head, Mechanical Engineering	member
3	**Prof. Rajesh Sahu**, Asstt Professor, Electrical Engineering	member
4	**Prof. Pankaj Dixit**, Assistant Professor, Civil Engineering	member

Goals & objectives of the committee shall remain as follows.

Committee Goals:

1. **Waste Management:** Implementing effective recycling programs, reducing single-use plastics, and promoting sustainable practices across campus.
2. **Energy Management:** Identifying opportunities for energy efficiency, promoting renewable energy sources, and raising awareness about energy conservation.
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Director
TIT Excellence
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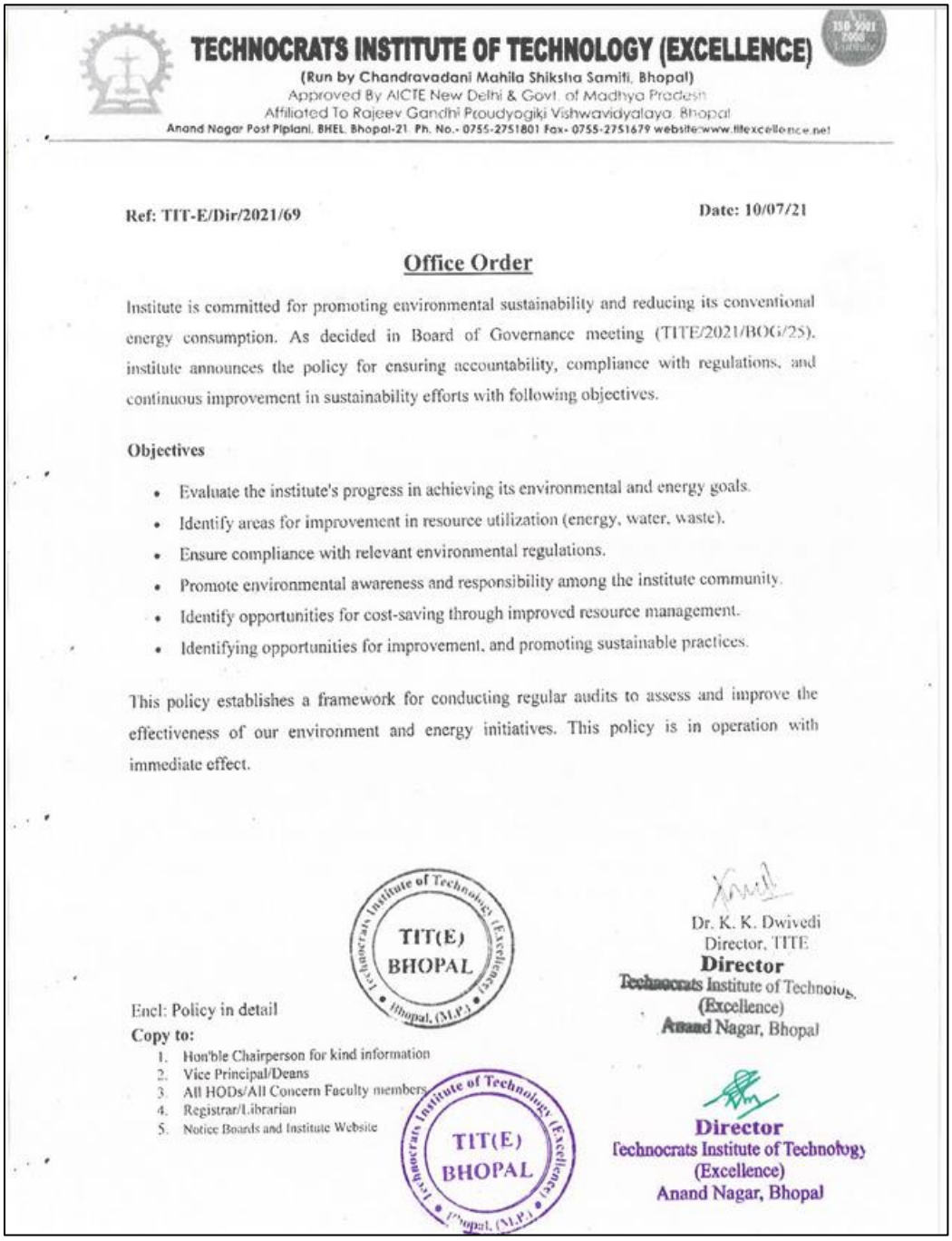
Anand Nagar, Bhopal

ENERGY AND ENVIRONMENT POLICY



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Ref: TIT-E/Dir/2021/69 Date: 10/07/21

Office Order

Institute is committed for promoting environmental sustainability and reducing its conventional energy consumption. As decided in Board of Governance meeting (TITE/2021/BOG/25), institute announces the policy for ensuring accountability, compliance with regulations, and continuous improvement in sustainability efforts with following objectives.

Objectives

- Evaluate the institute's progress in achieving its environmental and energy goals.
- Identify areas for improvement in resource utilization (energy, water, waste).
- Ensure compliance with relevant environmental regulations.
- Promote environmental awareness and responsibility among the institute community.
- Identify opportunities for cost-saving through improved resource management.
- Identifying opportunities for improvement, and promoting sustainable practices.

This policy establishes a framework for conducting regular audits to assess and improve the effectiveness of our environment and energy initiatives. This policy is in operation with immediate effect.

Technocrats Institute of Technology (Excellence) TIT(E) BHOPAL Bhopal, (M.P.)

Dr. K. K. Dwivedi
Director, TITE
Director
Technocrats Institute of Technology (Excellence)
Anand Nagar, Bhopal

Encl: Policy in detail

Copy to:

1. Hon'ble Chairperson for kind information
2. Vice Principal/Deans
3. All HODs/All Concern Faculty members
4. Registrar/Librarian
5. Notice Boards and Institute Website

Technocrats Institute of Technology (Excellence) TIT(E) BHOPAL Bhopal, (M.P.)

Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

Policy for Audit on Environment and Energy Initiatives

INTRODUCTION:

Being a leader in the Technical Educational Institution in the state, the institute is committed to develop and implement Green and Sustainable energysystem in thewholecampus,whichwill as a consequence spreadtheawarenessandmotivationinthesociety to move toward clean and sustainable energy resources.

SCOPE:

Thispolicyappliestoall stakeholders, students, staff andvisitors

COMMITTEE FOR AUDIT:

- It comprises of senior faculty (preferably Professor) as nominated by Director.
- Three senior faculty members (preferably Professor) as nominated by Director.
- Administrative staff

RESPONSIBILITIES:

- Audit committee or team will be responsible fordeveloping and implementing the audit plan, analyze data, and prepare reports.
- Institute' administrative staff will provide necessary resources and support for conducting the audits.
- Faculty and staff will be responsible for implementing and maintaining environmental and energy initiatives.
- They will also cooperate with the audit process and implement recommended actions.
- Students will participate in awareness campaigns and promote environmentally responsible practices.

AUDIT FREQUENCY AND TYPES:

- Audits will be conducted biannually.
- It will include Green /Environment audit, Energy audit etc.

POLICY

The institute confirms its commitment to environment and energy initiatives through the following practices:

Technocrats Institute of Technology (Excellence) TIT(E) BHOPAL

Technocrats Institute of Technology (Excellence) TIT(E) BHOPAL

Director
Technocrats Institute of Technology (Excellence)
Anand Nagar, Bhopal

1) Green audit / Environment audit
2) Energy audit
3) Clean and green campus initiatives
4) Beyond the campus environmental promotion activities

AUDIT DOCUMENTATION:

Audit committee

- Define outline requirements for documenting audit findings, conclusions, and recommendations.
- Define procedures for communicating audit results to relevant stakeholders, such as Institute' administration, faculty, and staff.
- Establish mechanisms for monitoring and tracking implementation of audit recommendations.

REVIEW

This policy will be reviewed and updated periodically if necessary to reflect changes in environmental regulations, best practices, and the Institute's evolving sustainability goals.

CONCLUSIONS:

By developing a comprehensive policy that addresses these aspects, the Institute effectively strives to continuously improve its environmental performance and contribute to a more sustainable future.

Dr. K. K. Dwivedi
Director, TITE
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

Discussed & finalized in meeting of Academic Council (TITE/2021/ACM/25) and submitted for information and approval in Board of Governance meeting.

Ms. Sadhna Karsoliya
Chairperson, TITE

Technocrats Institute of Technology (Excellence) TIT(E) BHOPAL Bhopal (M.P.)

Technocrats Institute of Technology (Excellence) TIT(E) BHOPAL Bhopal, (M.P.)

Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

POLICY ON ENERGY AND WATER CONSERVATION

TECHNOCRATS INSTITUTE OF TECHNOLOGY (EXCELLENCE)
(Run by Chandravadani Mahila Shiksha Samiti, Bhopal)
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Anand Nagar Post Piplani, BHEL Bhopal-21, Ph. No.- 0755-2751801 Fax- 0755-2751679 website:www.titexcellence.net

Ref: TIT-E/Dir/2021/68 Date: 09/07/21

Office Order

Institute is committed for energy conservation and fostering a culture of environmental responsibility among faculty, staff, and students. As decided in Board of Governance meeting (TITE/2021/BOG/25), institute announces the policy for ensuring energy conservation within the campus with following objectives.

Objectives

- Reduce overall energy consumption within the college.
- Promote the use of energy-efficient technologies and practices.
- Raise awareness about energy conservation through education and outreach programs.
- Continuously monitor and improve energy efficiency across the college.

The aim of this policy is to encourage and adopt practices that would lead to sustainable development, minimize carbon foot prints and depletion of natural resources and maximize recycling of resources. This policy is in operation with immediate effect.

Dr. K. K. Dwivedi
Director, TITE
Director
Technocrats Institute of Technology (Excellence)
Anand Nagar, Bhopal

TIT(E) BHOPAL

Encl: Policy in detail

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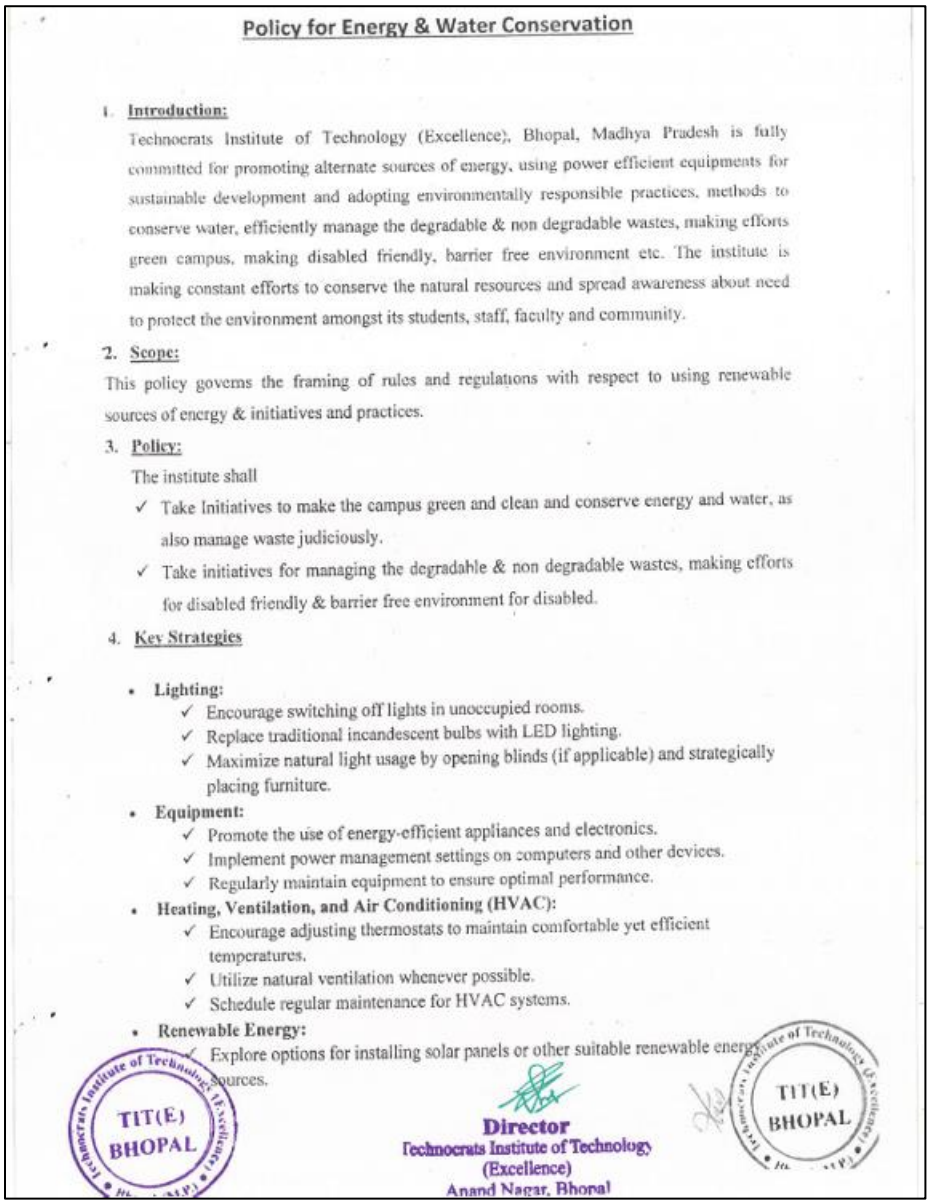


Policy for Energy & Water Conservation

1. **Introduction:**

Technocrats Institute of Technology (Excellence), Bhopal, Madhya Pradesh is fully committed for promoting alternate sources of energy, using power efficient equipments for sustainable development and adopting environmentally responsible practices, methods to conserve water, efficiently manage the degradable & non degradable wastes, making efforts green campus, making disabled friendly, barrier free environment etc. The institute is making constant efforts to conserve the natural resources and spread awareness about need to protect the environment amongst its students, staff, faculty and community.

2. **Scope:**

This policy governs the framing of rules and regulations with respect to using renewable sources of energy & initiatives and practices.

3. **Policy:**

The institute shall

- ✓ Take Initiatives to make the campus green and clean and conserve energy and water, as also manage waste judiciously.
- ✓ Take initiatives for managing the degradable & non degradable wastes, making efforts for disabled friendly & barrier free environment for disabled.

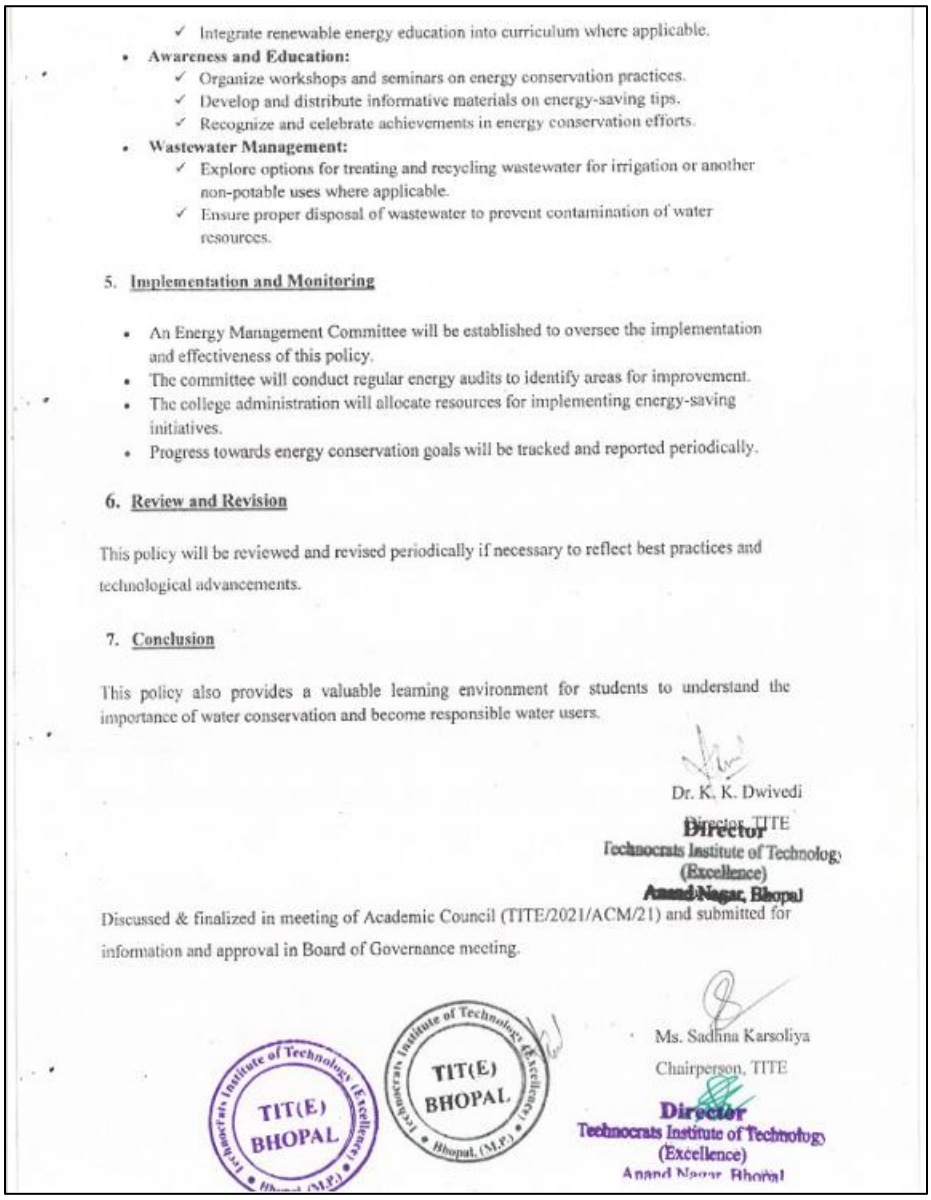
4. **Key Strategies**

- **Lighting:**
  - ✓ Encourage switching off lights in unoccupied rooms.
  - ✓ Replace traditional incandescent bulbs with LED lighting.
  - ✓ Maximize natural light usage by opening blinds (if applicable) and strategically placing furniture.
- **Equipment:**
  - ✓ Promote the use of energy-efficient appliances and electronics.
  - ✓ Implement power management settings on computers and other devices.
  - ✓ Regularly maintain equipment to ensure optimal performance.
- **Heating, Ventilation, and Air Conditioning (HVAC):**
  - ✓ Encourage adjusting thermostats to maintain comfortable yet efficient temperatures.
  - ✓ Utilize natural ventilation whenever possible.
  - ✓ Schedule regular maintenance for HVAC systems.
- **Renewable Energy:**
  - ✓ Explore options for installing solar panels or other suitable renewable energy sources.

TIT(E) BHOPAL

Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

TIT(E) BHOPAL



- ✓ Integrate renewable energy education into curriculum where applicable.

- **Awareness and Education:**
  - ✓ Organize workshops and seminars on energy conservation practices.
  - ✓ Develop and distribute informative materials on energy-saving tips.
  - ✓ Recognize and celebrate achievements in energy conservation efforts.
- **Wastewater Management:**
  - ✓ Explore options for treating and recycling wastewater for irrigation or another non-potable uses where applicable.
  - ✓ Ensure proper disposal of wastewater to prevent contamination of water resources.

5. **Implementation and Monitoring**

- An Energy Management Committee will be established to oversee the implementation and effectiveness of this policy.
- The committee will conduct regular energy audits to identify areas for improvement.
- The college administration will allocate resources for implementing energy-saving initiatives.
- Progress towards energy conservation goals will be tracked and reported periodically.

6. **Review and Revision**

This policy will be reviewed and revised periodically if necessary to reflect best practices and technological advancements.

7. **Conclusion**

This policy also provides a valuable learning environment for students to understand the importance of water conservation and become responsible water users.

Dr. K. K. Dwivedi
Director, TITE
Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

Discussed & finalized in meeting of Academic Council (TITE/2021/ACM/21) and submitted for information and approval in Board of Governance meeting.

TIT(E) BHOPAL

Ms. Sadhna Karsoliya
Chairperson, TITE
Director
Technocrats Institute of Technology
(Excellence)
Anand Nagar, Bhopal

EXECUTIVE SUMMARY

The executive summary of the energy audit report presented in this section briefly outlines the identified energy conservation measures and other recommendations proposed during the project. These energy conservation measures can be implemented in phases to conserve energy and enhance productivity within the **Technocrats Institute of Technology (Excellence),** campus. The expected total annual energy saving potential is 1, 28,189 (kWh) units.

INITIATIVE TAKEN BY THE INSTITUTE

- **Lighting System**
  - The institute has already taken steps to install energy-efficient lighting within the premises. This includes the replacement of conventional tube lights with energy-efficient LED lights. However, there remains significant potential for further improvement.

ENERGY AUDIT RECOMMENDATION

- **Lighting System**
  - ECM-1: There is a good potential to replace 738 numbers of conventional tube light T-8 (36W) by LED-T5 (20W). The expected energy saving potential is 35424 units per year.
  - ECM-2: There is a good potential to replace 270 numbers of 4x4 sq. fitting (18Wx4) replaced by 36W LED sq. fitting. The expected energy saving potential is 15552 units per year.
  - ECM-3: There is a good potential to replace 25 number of CFL (30W) by 15W LED. The expected energy saving potential is 750 units per year.
  - ECM-4: There is a good potential to replace 9 number of CFL (200W) replaced by LED 100W. The expected energy saving potential is 1800 units per year.
  - ECM-5: There is a good potential to replace 26 numbers of CFL (18W) by LED 9W. The expected energy saving potential is 468 units per year.

- **Ceiling fan**
  - ECM-6: There is a good potential to replace 1013 number of (60W) conventional ceiling fan by 28W BLDC fan. The expected energy saving potential is 55,715 units per year.

- **Split ACs**
  - ECM-7: There is a good potential to install Airtron intelligent microprocessor energy saver in 22 numbers of 2 and 3 ton star rated units. The expected energy saving potential is 18,480 units per year.
- **Timer-Controller and Motion sensor**
  - It is recommended to install "timer controller and motion sensor in faculty cabins, offices, and non-working areas.
- **Energy Monitoring System**
  - It was observed that there is a requirement of monthly energy consumption monitoring system to find out the annual energy consumption of the energy center, which should be based on a cloud-based (IoT) energy monitoring system.
  - The above system is highly recommended on solar plant and main electrical panel of the department. It serves both energy monitoring purposes and can act as a demonstration project for students and the management.
- **Awareness and Training program**
  - Conduct awareness and training program, poster presentation to promote energy saving activities in the center.

ENERGY CONSERVATION MEASURES

ECM	Identification	Observation	Recommendation	Annual Energy Saving (kWh)	Annual cost saving (Rs.)	Investment (Rs.)	Simple Payback period (Year)
ECM:1	738 no. Lighting	FTL-T8 (36W)	Replacement by LED-T5 (20W)	35,424	3,01,104/-	1,47,600/-	0.5
ECM:2	270 no. fixtures	4x4 ft^2 (18Wx4)	Replacement by 36W 1 sq.x1ft^2 LED	15,552	1,32,192/-	2,70,000/-	2
ECM:3	25 no. Lighting	CFL (30W)	Replacement by LED (15W)	750	6,375/-	5,000/-	1
ECM:4	9 no. Lighting	CFL (200W)	Replacement by LED 100W	1,800	15,300/-	13,500/-	1
ECM:5	26 no. of lighting	CFL (18W)	Replacement by 9W LED	468	3,978/-	2,600/-	0.7
ECM:6	1013 no. old ceiling fan	Conventional fan (60W)	Replaced by BLDC fan (28W)	55,715	4,73,577/-	28,36,400/-	6
ECM:7	22 no. 1.5 and 2 ton Star rated ACs	inefficient operation	Installation of Airtron 'Intelligent Microprocessor' energy saver	18,480	1,57,080/-	1,65,000/-	1.1
Total				**1,28,189**	**10,89,606/-**	**34,40,100/-**	**3.16**

Note: Energy saving will be depend on working hours and load factor of the equipment's

Chapter-1
INTRODUCTION

1.1 About Institute

Technocrats Institute of Technology (Excellence), Bhopal, MP, is one of the premier institutes of Madhya Pradesh. This is an educational institute which is known in central India for imparting quality & value-based education for the past 12 years. This institute was started with a clear vision to develop the institute into a center of excellence in engineering education in the country with global standards. The institute is affiliated to Rajiv Gandhi Proudyogiki Vishwavidyalaya (RGPV), Bhopal for B.Tech, M.Tech , MCA programs & affiliated to Barkatullah University, Bhopal for MBA program. The institute is located in Anand Nagar, Raisen Road, Bhopal.

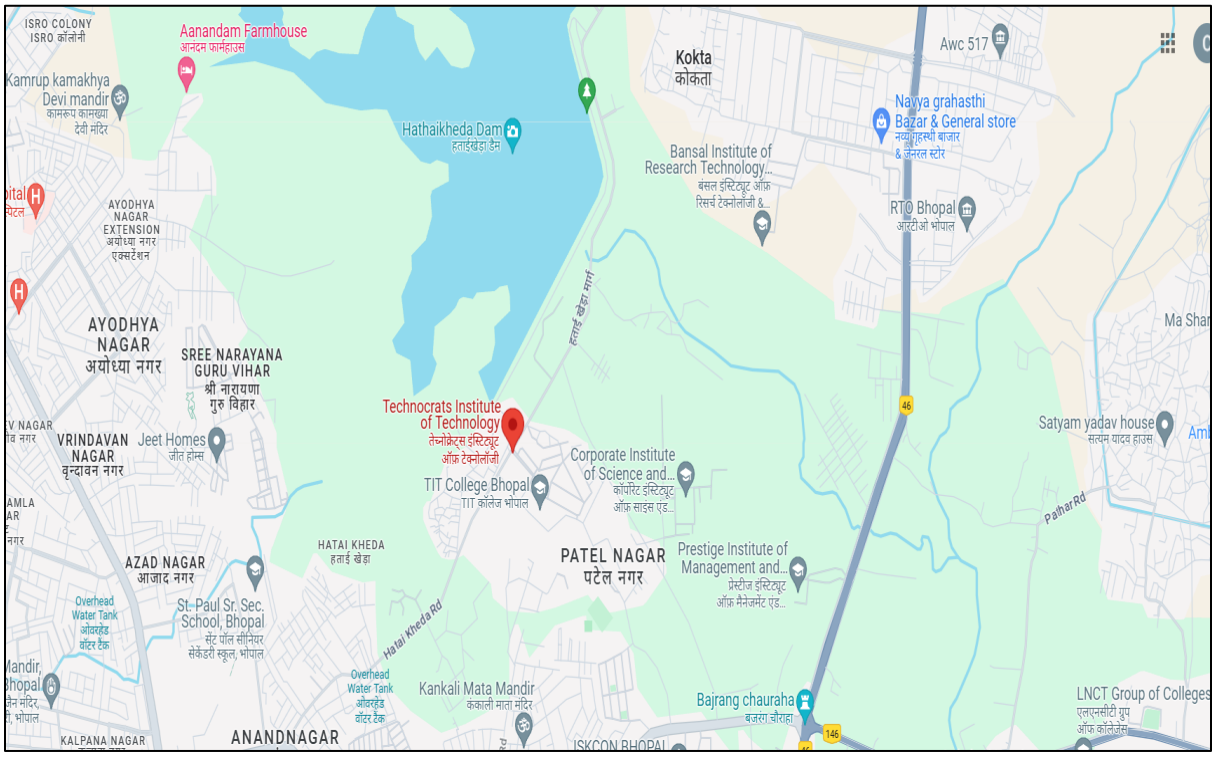


Figure1.1-Source: Satellite Image of TIT-Excellence, Bhopal (Madhya Pradesh)

The institute offers six courses at undergraduate level leading to bachelor's degree, B.Tech. in Electronics & Communication Engineering, Computer Science & Engineering, Civil Engineering, Electrical Engineering, Mechanical Engineering and CSE (Artificial Intelligence &

Machine Learning) disciplines. Apart from these courses, institute also offers admissions in master's degree, M.Tech. in Computer Science & Engineering, Construction Technology & Management and CSE (Artificial Intelligence & Machine Learning), Master of Computer Application (MCA) & Master of Business Administration (MBA). Presently the total intake is 600 in UG courses and 450 in PG courses.

Vision of the Institute

To become a "Centre of Excellence" for quality education in the field of engineering, research and management so as to produce globally competent and socially responsible professionals, who can contribute in technological and socio-economic development of the nation as a whole and region in particular.

Mission of the Institute

M.1: To educate students with deep professional knowledge through innovative teaching-learning process and to make them aware of cutting edge technology so as to become capable of understanding and addressing the issues of society, state and the country.

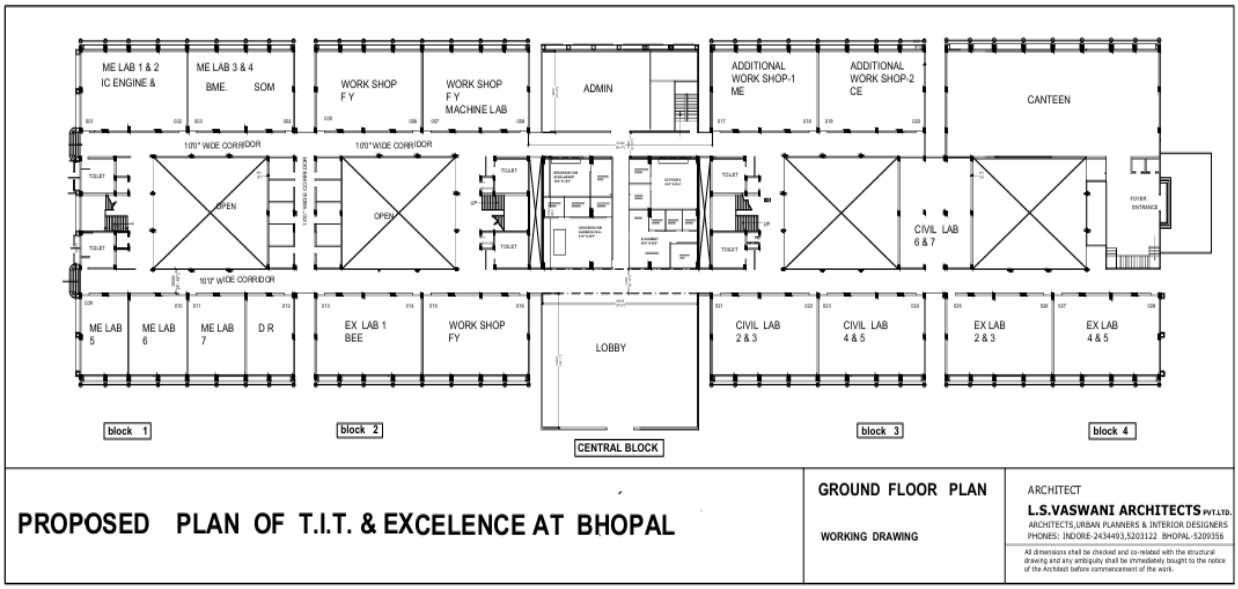
M.2: To create in- house facilities for research and innovation to provide solution to the industrial problems.

M.3: To inculcate right human values and professional ethics, leadership qualities, communication and entrepreneurship skills in students to meet the need of society.

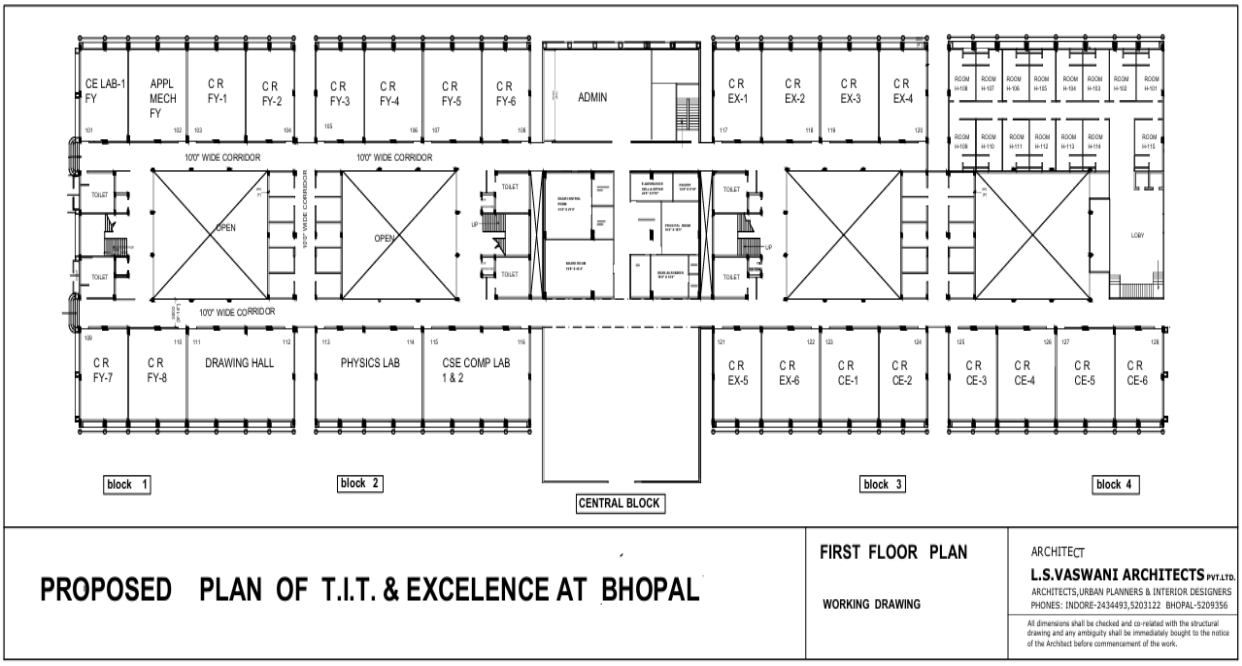
Institute Population

Sr. No.	Year	Teaching Staff (No.)	Non -Teaching Staff (No.)	Student (No.)
1	2020-21	212	98	2493
2	2021-22	212	98	2644
3	2022-23	213	98	2735

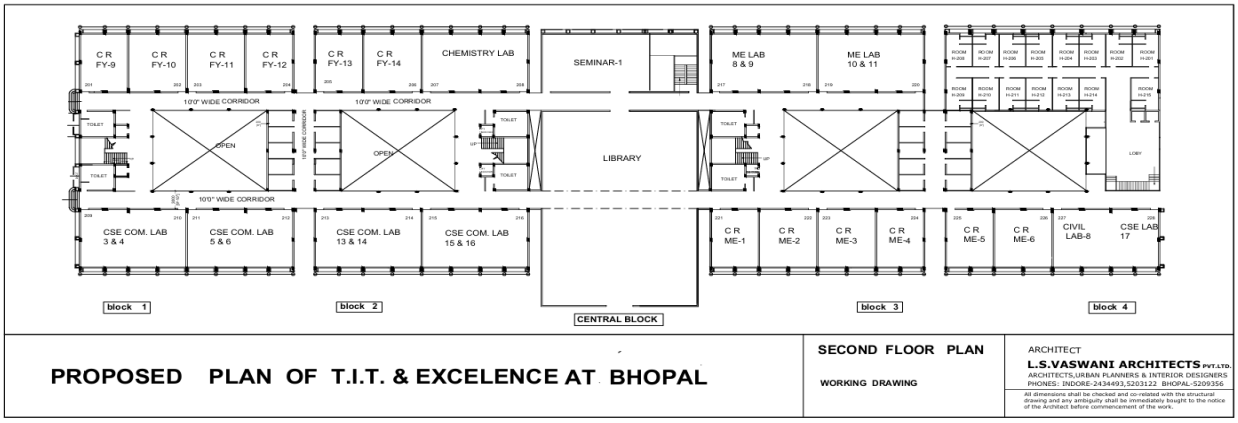
Institute Layout (Ground Floor Plan)



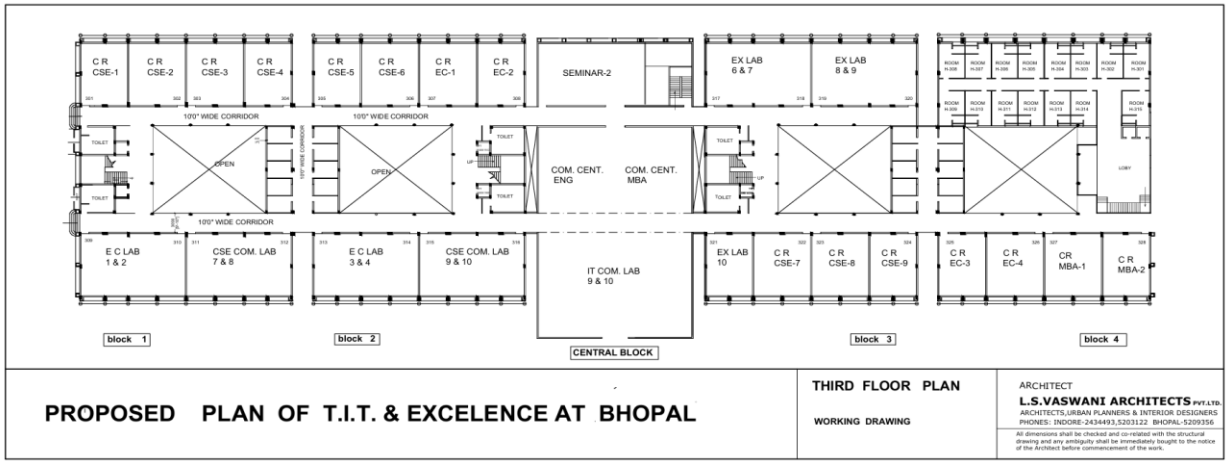
Institute Layout (First Floor Plan)



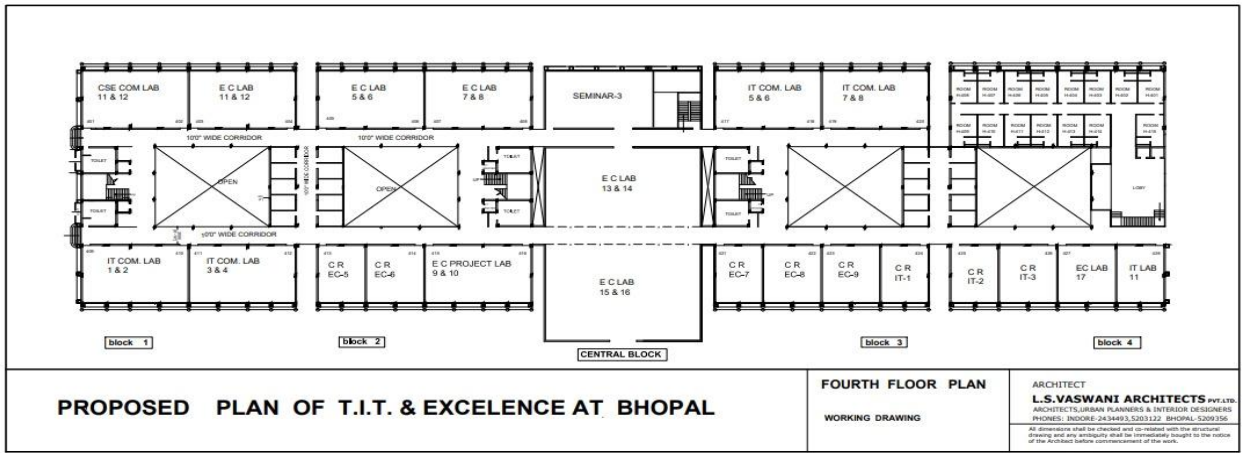
Institute Layout (Second Floor Plan)



Institute Layout (Third Floor Plan)



Institute Layout (Fourth Floor Plan)



Infrastructure





1.2 About Energy Audit

An energy audit serves to enhance understanding about how energy is utilized within a institute, aiding in the identification of areas susceptible to waste and potential areas for improvement. The overall energy efficiency, from generation to the end consumer, stands at 50%. Therefore, conserving one unit by the end user is equivalent to two units produced at the power plant.

An energy audit represents the most effective approach to discerning the strengths and weaknesses of energy management practices, while also offering solutions to existing issues. It embodies a professional means of responsible utilization of economic, financial, social, and natural resources. Energy audits contribute value to management control and serve as an evaluative method for systems.

Empirical Exergy Private Limited (EEPL), Indore, Madhya Pradesh, conducted an "Energy Audit" on-site to identify gaps in the energy consumption pattern at **Technocrats Institute of Technology (Excellence), Bhopal, (MP).** A technical report has been prepared in accordance with the requirements of the institute.

1.3 Objectives of Energy Auditing

Energy auditing provides a critical information foundation for an all-encompassing energy conservation initiative, encompassing energy utilization analysis and the evaluation of energy-saving measures.

Its objectives include:

- Identifying the cost and quality of different energy inputs
- Evaluating the current energy consumption patterns across various operational cost centers
- Establishing connections between energy inputs and production outputs.
- Identifying potential areas for thermal and electrical energy conservation.
- Pinpointing areas of major wastage.
- Setting energy-saving targets for individual cost centers.
- Implementing measures for energy conservation and realizing savings.

1.4 Methodology

The methodology employed to achieve the designated objectives, encompassing the assessment of current operational status and potential energy savings, encompasses the following steps:

- Engaging in discussions with relevant officials to identify key areas of focus and related systems.
- Sending a team of engineers to the site for discussions with concerned officials and supervisors, aiming to gather data and information regarding plant operations and load distribution across the premises. The collected data were analyzed to establish a baseline energy consumption pattern.
- Utilizing suitable instruments for measurements and monitoring, including continuous and/or time-lapse recording as appropriate, coupled with visual observations to discern energy usage patterns and system losses.
- Conducting trend analysis for costs and consumption patterns.
- Carrying out capacity and efficiency tests on major utility equipment, wherever applicable.
- Estimating various forms of losses.
- Performing computations and in-depth analysis of the gathered data, utilizing computerized analysis and relevant techniques where appropriate, to derive conclusions and formulate an effective energy conservation plan to enhance and reduce specific energy consumption.

CHAPTER-2
POWER SUPPLY SYSTEM

2.1 Power supply system

The power supply for the institute is primarily sourced from the grid, solar energy and in case of a power failure, it is supplied by the DG sets.

2.1.1 Grid Power

The institute acquires energy in the form of electricity procured from the Madhya Pradesh Madhya Kshetra Vidyut Vitaran co. Ltd. Bhopal with the help of 33 KV power supply under tariff HV-3.2B Non- industrial feeder. The power is drawn by 500 KVA Step down transformer at 433Voltage. The Detailed of above transformer is given in table 2.1

Table 2.1: Technical Specification of 500 KVA Transformer

Sr. No.	Items	Technical Specification
1	Make	CG
2	Year	2013
3	Rating (KVA)	500
4	Voltage (HV/ LV)	33000/433
5	Current Rating (HV/ LV)	8.75/666
6	Frequency (Hz)	50
7	Type of cooling	ONAN

Fig.2.1 Transformer (500 KVA) at 33 KV Sub-station

2.1.2 Solar Energy

The institute has 5 KWp solar energy off grid roof top system. During the audit, System is under working. The detailed of Solar panels are given in table 2.2

Table: 2.2 Solar system technical Specification

Sr. No.	Description	Solar Panel Type-I	Solar Panel Type-I	Solar Panel Type-I
1	Make	Fujiyama	Luminous	Topsun
2	Model	UTL 335W-24V	PSS-24325	TEL 12P100
3	Rated Power (P_{max})	335 W	325 W	100W
4	Rated Voltage (P_{max})	39.01 V	38 V	17.5 V
5	Rated Current(Imp)	8.60 A	8.55 A	5.79 A
6	Open Circuit Voltage (V_{oc})	46.15 V	45.5V	21.5 V
7	Short Circuit Current (I_{sc})	9.09 A	9.07A	6.38 A
8	Output tolerance	0 to +3%	3%	3%
9	Maximum System Voltage	1000 V	1000 V	1000 V
10	Module Efficiency	17.70%	NA	NA

Observation:

It was observed that there is the requirement of energy monitoring system. It will help to monitor energy generation by the system per day. It will also help to determine performance assessment and Capacity Utilization Factor of the system. The expected energy generation@3.50 kWh/KWp/Day is 6388 units per year.

2.1.3 DG Set

The institute has 125 KVA DG set, is used in case of grid power supply is interrupted. During the audit, System is under working. The detailed of DG set given in table 2.3

Table: 2.3 DG Set technical Specification

Sr. No.	Parameter	Description	Unit
1	Make	Greaves Cotton Ltd.	
2	Model No.	GPWII-PII-125	
3	Rated Capacity	125	kVA
4	Rated Voltage	415	V
5	Rated Current		Amp
6	Power Factor	0.8	Ø
7	Frequency	50	Hz
8	Rated Speed	1500	Rev/Min

Observation:

- DG set is used only in case of grid power is interrupted.
- Annual diesel consumption was 1270 lit. in year 2021-22 and 830 lit for the year 2022-23.
- There is requirement of energy meter to maintain record of energy generation by the system. It will help to determine Specific Energy generation of the DG Set (kWh/Lit of Fuel).

CHAPTER-3
ELECTRICITY BILL ANALYSIS

3.1 Annual Energy Consumption:

The institute fulfill the requirement of energy consumption from grid power and solar energy generation by off grid solar power system. The detailed of annual energy consumption and overall per unit charges from grid supply in last 2 year is given in table 3.1.1 and share of solar energy is given in table 3.1.2

Table 3.1.1: Annual Energy consumption of Grid Year 2021-22 and 3022-23

Year	Unit Consumption (kWh/Year)	Annual Bill Amount (Rs.)	Overall Per Unit Charges (Rs./kWh)
2021-22	390751	4561901	11.67
2022-23	499663	5493753	10.99

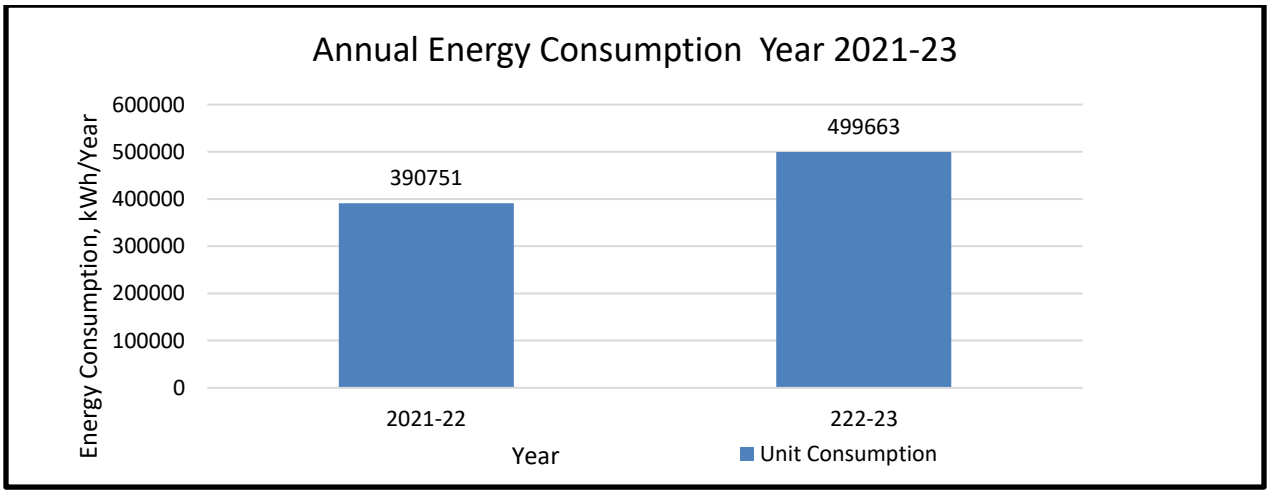


Table 3.1.2: Solar energy and Grid power consumption share

Year	Grid Unit Consumption	Solar Unit Generation	Total Energy Consumption (kWh/Year)	Share (%)
2021-22	3,90,751	7300	3,98,051	1.83
2022-23	4,99,663	6388	5,06,051	1.26

Observation: The solar energy share is 1.26 % to 1.83 % of the total energy consumption of the institute.

3.2 Monthly Energy Consumption (Year 2021-22 & 2022-23)

Monthly Energy Consumption compares the unit energy consumption for the years 2021-22 and 2022-23 of the institute.

Table 3.2: Monthly Energy Consumption Year 2021-22, and Year-2022-23

Sr. no	Month	Unit Consumption (2021-22)	Current Month Bill (Rs.)	Unit consumption 2022-23	Current Month Bill (Rs.)
1	April	29786	560275	50685	560275
2	May	29011	345390	70689	774443
3	June	36084	391944	66285	684566
4	July	43010	429825	47348	531526
5	August	36633	392862	37668	429297
6	September	35684	377970	41076	443062
7	October	35355	378601	36069	395867
8	November	28631	333811	31982	355334
9	December	30308	336460	29592	324661
10	January	29162	348950	30148	342415
11	February	29025	343889	29006	327702
12	March	28062	321924	29115	324605
13	**Total**	**3,90,751**	**45,61,901/-**	**4,99,663**	**54,93,753/-**

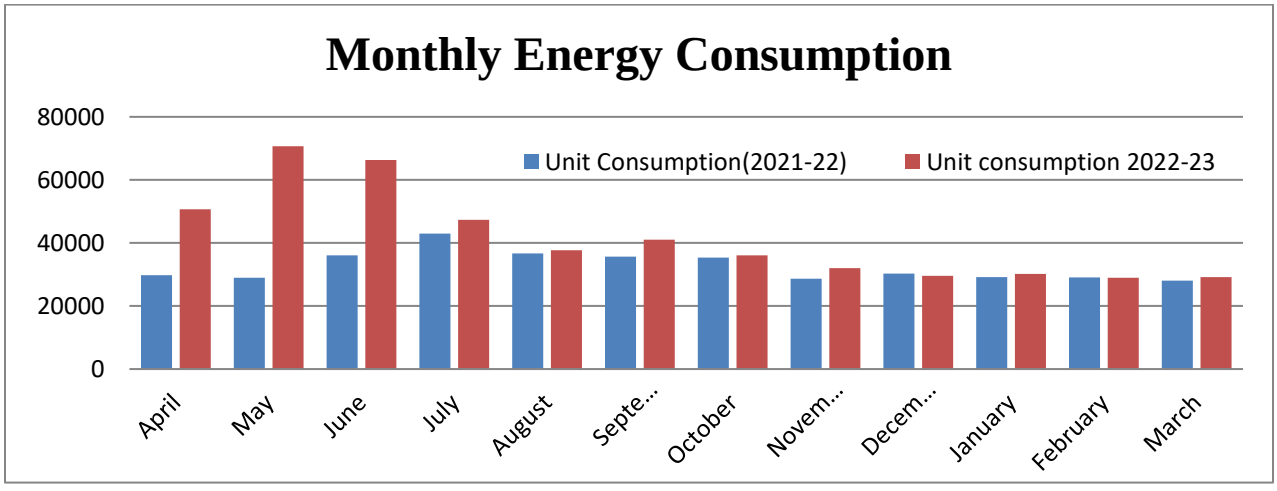


Fig.3.2: Monthly energy consumption for the year 2021-22, year 2022-23

Observations:

- It was observed that an increase in monthly energy consumption in the year 2022-23 compared to 2021-22, especially noticeable during the summer months.

3.3 Monthly Demand Analysis (Year 2021-22 & 2022-23): Maximum Demand Consumption compares the maximum demand in KVA (kilovolt-amperes) for two different periods: 2021-22 and 2022-23, over a span of 12 months from April to March.

Table 3.3: Monthly Maximum Demand (Year 2021-22 & 2022-23)

Sr. No.	Month & Year	Contract Demand	Maximum Demand (2021-22)	Billing Demand (2021-22)	Maximum Demand (2022-23)	Billing Demand (2022-23)
1	April	200	112	180	**269**	269
2	May	200	160	180	**309**	309
3	June	200	136	180	**165**	270
4	July	200	163	180	**258**	258
5	August	200	136	180	**213**	213
6	September	200	128	180	186	186
7	October	200	180	180	150	180
8	November	200	141	180	128	180
9	December	200	113	180	98	180
10	January	200	105	180	107	180
11	February	200	107	180	93	180
12	March	200	165	180	181	181

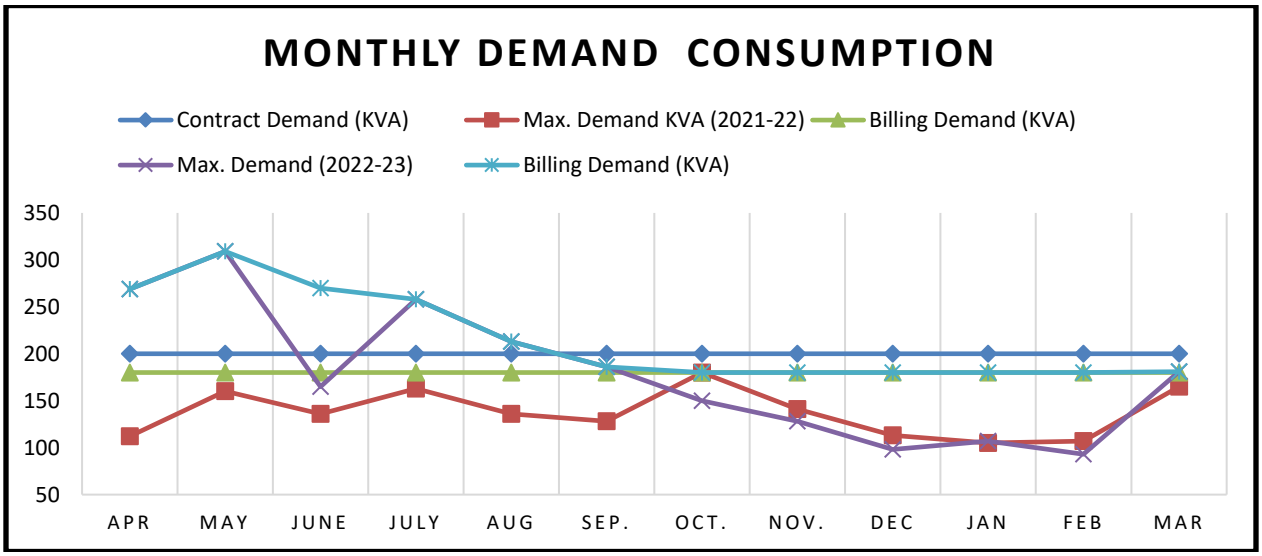


Fig.3.3 Monthly Maximum Demand for the year (2021-22) and year (2022-23)

Observations: For the period 2022-23, The maximum demand is highest in May (309 KVA) and lowest in February (93 KVA).

3.4 Monthly Power Factor Analysis (Year 2021-22 & 2022-23): Monthly power factor analysis for two different periods: 2021-22 and 2022-23, over a span of 12 months.

Table 3.4 Monthly Power Factor (Year 2021-22 & 2022-23)

Sr. No.	Month	Average Power Factor (2021-22)	Average Power Factor (2022-23)
1	April	0.836	0.924
2	May	0.865	0.903
3	June	0.840	0.976
4	July	0.876	0.893
5	August	0.844	0.865
6	September	0.868	0.912
7	October	0.868	0.936
8	November	0.818	0.949
9	December	0.845	0.998
10	January	0.811	0.988
11	February	0.815	0.990
12	March	0.853	0.990
	Average	**0.845**	**0.944**

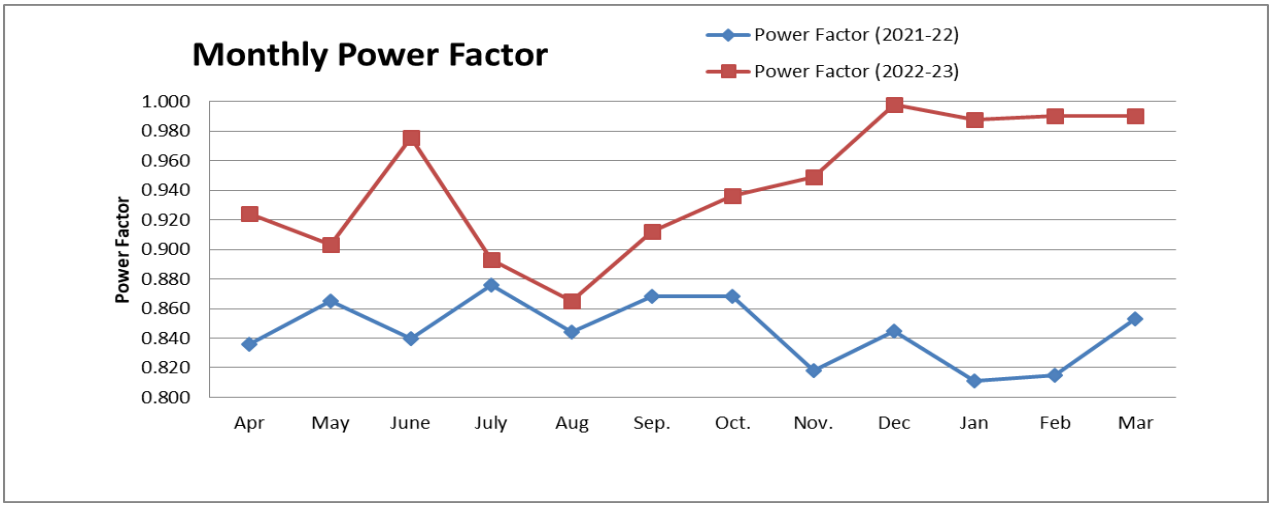


Fig.3.4: Monthly Power Factor for the year (2021-22) and year (2022-23)

Observation:

The average power factor was 0.845 for the year 2021-22, its shows a significant improvement 0.944 in the year 2022-23. Still there is good potential for improvement up to unity.

3.5 Monthly Overall per unit Charges:

The unit charges represent the cost of electricity per kilowatt-hour. The unit charges for each month in the years 2021-22 and 2022-23, along with their averages.

Table 3.5 Energy Charges unit charges (Year 2021-22 & 2022-23)

Sr. No	Month	Unit Charges (Rs./kWh) 2021-22	Unit Charges (Rs./kWh) 2022-23
1	April	18.81	11.05
2	May	11.91	10.96
3	June	10.86	10.33
4	July	9.99	11.23
5	August	10.72	11.40
6	Sep	10.59	10.79
7	Oct	10.71	10.98
8	Nov	11.66	11.11
9	Dec	11.10	10.97
10	Jan	11.97	11.36
11	Feb	11.85	11.30
12	March	11.47	11.15
	Average	**11.80**	**11.05**

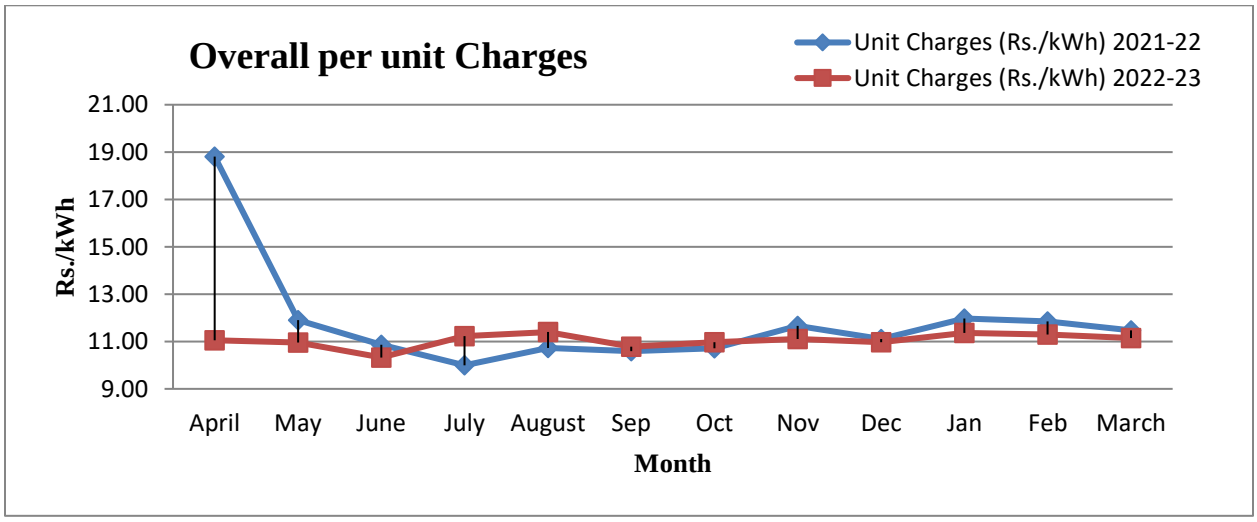


Fig.3.5: Per Unit charges for the year (2021-22) and year (2022-23)

Observation: Average Overall energy charges for the year 2021-22 is Rs. 11.80 and for year 2022-23 is Rs. 11.05 per unit.

CHAPTER-4
CONNECTED LOAD ANALYSIS

4.1 Connected Load Detailed

During the energy audit details of the electrical appliances has been verified in the institute building. Details of the electrical appliances is given in the table 4.1

Table-4.1 Details of the lighting, load

Sr. no	Location	Name	FTL 36W	LED tube 20W	Down light 4*4 (18*4) 72W	Down light4*4 (10*4) 40W	CFL Down Light 30W	CFL 18W	LED Down lighter 18W	Led Down Lighter 50W	LED 9W	LED 50W	CFL 200W	LED 120W
1	A01		5	0	0	0	0	0	0	0	0	0	0	0
2	A02		0	7	0	0	0	0	0	0	0	0	0	0
3	A 03		4	0	0	0	0	0	0	0	0	0	0	0
4	A 04	Office	0	0	1	0	0	0	0	0	0	0	0	0
5		Director's room	0	0	0	4	0	0	0	0	0	0	0	0
6		Executive director office	0	0	16	4	5	0	0	0	0	0	0	0
7	A 05	Electrical lab	8	0	0	0	0	0	0	0	0	0	0	0
8		RAC lab	4	0	0	0	0	0	0	0	0	0	0	0
9	A 07		4	0	0	0	0	0	0	0	0	0	0	0
10	A 09		2	0	0	0	0	0	0	0	0	0	0	0
11	A 10		8	0	0	0	0	0	0	0	0	0	0	0
12	A 12		8	0	0	0	0	0	0	0	0	0	0	0
13	A 13 + A14	Strength of material	16	0	0	0	0	0	0	0	0	0	0	0

Sr. no	Location	Name	FTL 36W	LED tube 20W	Down light 4*4 (18*4) 72W	Down light4*4 (10*4) 40W	CFL Down Light 30W	CFL 18W	LED Down lighter 18W	Led Down Lighter 50W	LED 9W	LED 50W	CFL 200W	LED 120W
		lab												
14		Staff wash room	1	0	0	0	0	0	0	0	0	0	0	0
15	A 101		3	0	0	0	0	0	0	0	0	0	0	0
16	A 102		4	0	0	0	0	0	0	0	0	0	0	0
17	A 103		4	0	0	0	0	0	0	0	0	0	0	0
18	A104		8	0	0	0	0	0	0	0	0	0	0	0
19	A 105		0	5	0	0	0	0	0	0	0	0	0	0
20	A 106		6	0	0	0	0	0	0	0	0	0	0	0
21	A 111		4	0	0	0	0	0	0	0	0	0	0	0
22	A 112		4	0	0	0	0	0	0	0	0	0	0	0
23	A113		4	0	0	0	0	0	0	0	0	0	0	0
24	A 114		4	0	0	0	0	0	0	0	0	0	0	0
25	A 115		4	0	0	0	0	0	0	0	0	0	0	0
26	A 116		4	0	0	0	0	0	0	0	0	0	0	0
27	A 117		4	0	0	0	0	0	0	0	0	0	0	0
28	A 118		4	0	0	0	0	0	0	0	0	0	0	0
29	A 107	WASH ROOM	0	0	0	0	0	0	0	0	0	0	0	0
30	A109		10	0	20	0	5	0	0	0	0	0	0	0
31	A 201		2	0	0	0	0	0	0	0	0	0	0	0
32	A 202		12	0	0	0	0	0	0	0	0	0	0	0
33	A 202 II		0	0	16	0	0	8	0	0	0	0	0	0
34	A 203		0	0	0	0	0	0	0	0	0	0	0	0

Sr. no	Location	Name	FTL 36W	LED tube 20W	Down light 4*4 (18*4) 72W	Down light4*4 (10*4) 40W	CFL Down Light 30W	CFL 18W	LED Down lighter 18W	Led Down Lighter 50W	LED 9W	LED 50W	CFL 200W	LED 120W
35	A 209		4	0	0	0	0	0	0	0	0	0	0	0
36	A 210		4	0	0	0	0	0	0	0	0	0	0	0
37	A 211		4	0	0	0	0	0	0	0	0	0	0	0
38	A 212		4	0	0	0	0	0	0	0	0	0	0	0
39	A 213		4	0	0	0	0	0	0	0	0	0	0	0
40		Male wash room		1	0	0	0	0	0	0	0	0	0	0
41	A 301		2	0	0	0	0	0	0	0	0	0	0	0
42	A 302		0	0	8	0	0	0	0	0	0	0	0	0
43	A 303		0	0	8	0	0	0	0	0	0	0	0	0
44	A 305		0	0	16	0	0	0	0	0	0	0	0	0
45	A 306-307		0	0	16	0	0	0	0	0	0	0	0	0
46	A 308-309		0	0	16	0	0	0	0	0	0	0	0	0
47	A 310		0	2	0	0	0	0	0	0	0	0	0	0
48	A 312		3	0	0	0	0	0	0	0	0	0	0	0
49	A 313		3	0	0	0	0	0	0	0	0	0	0	0
50	A 314		3	0	0	0	0	0	0	0	0	0	0	0
51	A 315		3	0	0	0	0	0	0	0	0	0	0	0
52	A 316		3	0	0	0	0	0	0	0	0	0	0	0
53	A 317		3	0	0	0	0	0	0	0	0	0	0	0
54	A 318		3	0	0	0	0	0	0	0	0	0	0	0
55	A 319		3	0	0	0	0	0	0	0	0	0	0	0
56	WASH ROOM		1	0	0	0	0	0	0	0	0	0	0	0

Sr. no	Location	Name	FTL 36W	LED tube 20W	Down light 4*4 (18*4) 72W	Down light4*4 (10*4) 40W	CFL Down Light 30W	CFL 18W	LED Down lighter 18W	Led Down Lighter 50W	LED 9W	LED 50W	CFL 200W	LED 120W
57	A 401		0	0	0	0	0	0	0	0	0	0	0	0
58	A 402		4	0	0	0	0	0	0	0	0	0	0	0
59	A 403		12	0	0	0	0	0	0	0	0	0	0	0
60	A 404		4	0	0	0	0	0	0	0	0	0	0	0
61	A 405		4	0	0	0	0	0	0	0	0	0	0	0
62	A406-407		0	0	14	0	0	0	0	0	0	0	0	0
63	A 408-409		0	0	16	0	0	0	0	0	0	0	0	0
64	A 410		0	0	8	0	0	0	0	0	0	0	0	0
65	A 411-412		0	0	16	0	0	0	0	0	0	0	0	0
66	A 413		4	0	0	0	0	0	0	0	0	0	0	0
67	A 414		4	0	0	0	0	0	0	0	0	0	0	0
68	A 415-416		0	0	16	0	0	0	0	0	0	0	0	0
69		Dept. of EC	0	0	20	0	0	0	0	0	0	0	0	0
70	B block	Material testing lab	8	0	0	0	0	0	0	0	0	0	0	0
71	B03	Geo technical lab	8	0	0	0	0	0	0	0	0	0	0	0
72	B04	Transformation Engg.Lab	8	0	0	0	0	0	0	0	0	0	0	0
73	B 05	Project lab	8	0	0	0	0	0	0	0	0	0	0	0
74	B 06	Electrical machine lab	16	0	0	0	0	0	0	0	0	0	0	0
75	B 07	Store	16	0	0	0	0	0	0	0	0	0	0	0
76	B 08		10	0	0	0	0	0	0	0	0	0	0	0

Sr. no	Location	Name	FTL 36W	LED tube 20W	Down light 4*4 (18*4) 72W	Down light4*4 (10*4) 40W	CFL Down Light 30W	CFL 18W	LED Down lighter 18W	Led Down Lighter 50W	LED 9W	LED 50W	CFL 200W	LED 120W
77	B 09	Conference hall	8	0	0	0	0	0	0	0	0	0	0	0
78	B 10		7	1	0	0	0	0	0	0	0	0	0	0
79	B 11	Registrar office	16	0	0	0	0	0	0	0	0	0	0	0
80	B 12		1	0	0	0	0	0	0	0	0	0	0	0
81	B 13		1	0	0	0	0	0	0	0	0	0	0	0
82		Corridor	8	1	0	0	0	0	0	0	0	0	0	0
83	B 101	Wash room	1	0	0	0	0	0	0	0	0	0	0	0
84	B 102	Civil Engg. Lab	8	0	0	0	0	0	0	0	0	0	0	0
85	B 103	Engg. Geology lab	8	0	0	0	0	0	0	0	0	0	0	0
86	B 104	B.M.E Lab	8	0	0	0	0	0	0	0	0	0	0	0
87	B 105	Class room	8	0	0	0	0	0	0	0	0	0	0	0
88	B 106	Class room	8	0	0	0	0	0	0	0	0	0	0	0
89	B 107	Class room	8	0	0	0	0	0	0	0	0	0	0	0
90	B 108	Class room	8	0	0	0	0	0	0	0	0	0	0	0
91	B 109	Store room	8	0	0	0	0	0	0	0	0	0	0	0
92	B 110	Dept. of Civil Engg. Office	0	0	5	2			0	0	0	0	0	0
93	B 111	Civil Library	8	0	0	0	0	0	0	0	0	0	0	0

Sr. no	Location	Name	FTL 36W	LED tube 20W	Down light 4*4 (18*4) 72W	Down light4*4 (10*4) 40W	CFL Down Light 30W	CFL 18W	LED Down lighter 18W	Led Down Lighter 50W	LED 9W	LED 50W	CFL 200W	LED 120W
94	B 112	Class room	8	0	0	0	0	0	0	0	0	0	0	0
95	B 113	Class room	8	0	0	0	0	0	0	0	0	0	0	0
96	B 114	Class room	8	0	0	0	0	0	0	0	0	0	0	0
97	B 115	Wash room	1	0	0	0	0	0	0	0	0	0	0	0
98	B 116	staff wash room		1	0	0	0	0	0	0	0	0	0	0
99	B 201	Wash room	1	1	0	0	0	0	0	0	0	0	0	0
100	B 202	CAD Lab	8	0	0	0	0	0	0	0	0	0	0	0
101	B 203	Class room	8	0	0	0	0	0	0	0	0	0	0	0
102	B 204	Class room	8	0	0	0	0	0	0	0	0	0	0	0
103	B 205	Class room	8	0	0	0	0	0	0	0	0	0	0	0
104	B 206	tutorial room	8	0	0	0	0	0	0	0	0	0	0	0
105	B 207	Class room	8	0	0	0	0	0	0	0	0	0	0	0
106	B 208	NCC Office	8	0	0	0	0	0	0	0	0	0	0	0
107	B 209	Yoga meditation	8	0	0	0	0	0	0	0	0	0	0	0
108	B 210	Dept of Elec. & Electronic HOD		0	2	0	5	18	0	0	0	0	0	0
109	B 211	Control System lab	16	0	0	0	0	0	0	0	0	0	0	0

Sr. no	Location	Name	FTL 36W	LED tube 20W	Down light 4*4 (18*4) 72W	Down light4*4 (10*4) 40W	CFL Down Light 30W	CFL 18W	LED Down lighter 18W	Led Down Lighter 50W	LED 9W	LED 50W	CFL 200W	LED 120W
110	B 212		16	0	0	0	0	0	0	0	0	0	0	0
111	B 213	Wash room	1	1	0	0	0	0	0	0	0	0	0	0
112	B 214	Wash room (male)	1	0	0	0	0	0	0	0	0	0	0	0
113		Corridor	10	4	0	0	0	0	0	0	0	0	0	0
114	B 301	Wash room Boys	1	0	0	0	0	0	0	0	0	0	0	0
115	B 302	tutorial room	8	0	0	0	0	0	0	0	0	0	0	0
116	B 303	tutorial room	8	0	0	0	0	0	0	0	0	0	0	0
117	B 304	PG research Lab	0	0	0	0	0	0	0	0	0	0	0	0
118	B 305	Software Engg.	16	0	0	0	0	0	0	0	0	0	0	0
119	B 306	tutorial room	8	0	0	0	0	0	0	0	0	0	0	0
120	B 307	Class room	8	0	0	0	0	0	0	0	0	0	0	0
121	B 308	Computer Networking lab	0	0	16	0	0	0	0	0	0	0	0	0
122	B 309	T & P Cell	0	0	20	0	5	0	0	0	0	0	0	0
123	B 310	T&P Hall	12	0	0	0	0	0	0	0	0	0	0	0
124	B 311	Seminar hall	12	0	0	0	0	0	0	0	0	0	0	0
125	B 312	Wash Room Boys	1	0	0	0	0	0	0	0	0	0	0	0

Sr. no	Location	Name	FTL 36W	LED tube 20W	Down light 4*4 (18*4) 72W	Down light4*4 (10*4) 40W	CFL Down Light 30W	CFL 18W	LED Down lighter 18W	Led Down Lighter 50W	LED 9W	LED 50W	CFL 200W	LED 120W
126	B 313	Wash room girls	1	0	0	0	0	0	0	0	0	0	0	0
127	B 401	Wash Room Boys	1	0	0	0	0	0	0	0	0	0	0	0
128	B 402	Class room	16	0	0	0	0	0	0	0	0	0	0	0
129	B 403	Class room	16	0	0	0	0	0	0	0	0	0	0	0
130	B 404	EDC Project Lab	16	0	0	0	0	0	0	0	0	0	0	0
131	B 405	tutorial room	8	0	0	0	0	0	0	0	0	0	0	0
132	B 406		8	0	0	0	0	0	0	0	0	0	0	0
133	B 407		0	0	20	0	5	0	0	0	0	0	0	0
134	B 408	Class room	16	0	0	0	0	0	0	0	0	0	0	0
135	B 409	T&P Hall	16	0	0	0	0	0	0	0	0	0	0	0
136	B 410	Wash room	1	0	0	0	0	0	0	0	0	0	0	0
137	B 411	Wash room	1	0	0	0	0	0	0	0	0	0	0	0
138	C 102	Conferenc e hall	0	0	0	0	0	0	8	0	0	0	0	0
139	C 103	Conferenc e hall	0	0	0	0	0	0	8	0	0	0	0	0
140	C 101	Guest room	0	0	0	0	0	0	9	0	0	0	0	0
141	C 301		0	4	0	0	0	0	0	0	0	0	0	0
142	C 302		0	0	0	0	0	0	18	0	0	0	0	0
143		Seminar hall T&P	0	0	0	0	0	0	16	0	0	0	0	0

Sr. no	Location	Name	FTL 36W	LED tube 20W	Down light 4*4 (18*4) 72W	Down light4*4 (10*4) 40W	CFL Down Light 30W	CFL 18W	LED Down lighter 18W	Led Down Lighter 50W	LED 9W	LED 50W	CFL 200W	LED 120W
144		PPT Hall	0	0	0	0	0	0	66	64	0	0	0	0
145	Boys Hostel		12	45	0	0	0	0	0	0	45	0	0	0
146	GYM		10	0	0	0	0	0	0	0	0	5	9	0
147		Campus Street Light	0	0	0	0	0	0	0	0	0	0	0	10
	Total		**738**	**73**	**270**	**10**	**25**	**26**	**125**	**64**	**45**	**5**	**9**	**10**

Electrical Appliance Load Share percentage of the Institute

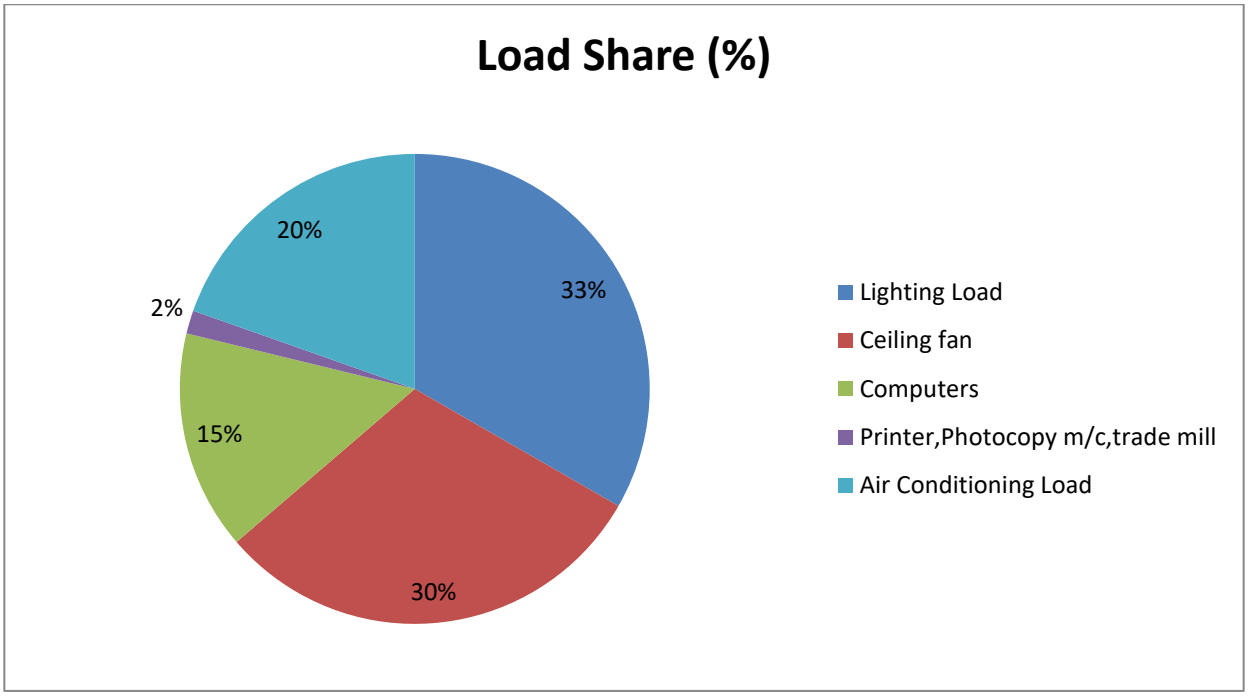


Fig.4.1: Load Share of the TIT Excellence Building

Sr. No.	Appliances	Load Share (%)
1	Lighting Load	33.3
2	Ceiling fan	30.4
3	Computers	15.1
4	Printer, Photocopy m/c, trade mill	1.6
5	Air Conditioning Load	19.6
		100

Observation:

It is observed that lighting load is dominated with 33.3% of the total load while ceiling fan load is 30.4%.

Table 4.2: Details of the other electrical appliance load like AC, Computer, printer, photocopy m/c etc.

Sr. no	Location	Name	Fan	PC	Printer	Photo Copy. machine	AC	Wall fan	Trade mill
1	A01		6	0	0	0	0	0	0
2	A02		6	3	1	1	0	0	0
3	A 03		6	0	0	0	0	0	0
4	A 04	Office	2	2	1	0	0	0	0
5		Director room	2	1	1	0	1	0	0
6		EXECUTIVE director office	10	30	1	1	2	0	0
7	A 05	Electrical lab	12	0	0	0	0	0	0
8		RAC lab	6	0	0	0	0	0	0
9	A 07		4	0	0	0	0	0	0
10	A 09		1	0	0	0	0	0	0
11	A 10		12	0	0	0	0	0	0
12	A 12		12	0	0	0	0	0	0
13	A 13 + A14	Strength of material lab	24	0	0	0	0	0	0
14		Staff wash room	0	0	0	0	0	0	0
15	A 101		1	2	0	0	0	1	0
16	A 102		6	0	0	0	0	0	0
17	A 103		6	0	0	0	0	0	0
18	A104		12	0	0	0	0	0	0
19	A 105		9	0	0	0	0	0	0
20	A 106		12	0	0	0	0	0	0
21	A 111		6	0	0	0	0	0	0

Sr. no	Location	Name	Fan	PC	Printer	Photo Copy. machine	AC	Wall fan	Trade mill
22	A 112		6	0	0	0	0	0	0
23	A113		6	0	0	0	0	0	0
24	A 114		6	0	0	0	0	0	0
25	A 115		6	0	0	0	0	0	0
26	A 116		6	0	0	0	0	0	0
27	A 117		6	0	0	0	0	0	0
28	A 118		6	0	0	0	0	0	0
29	A 107	Wash room	0	0	0	0	0	0	0
30	A109		0	0	0	0	0	0	0
31	A 201		1	1	1	0	1	0	0
32	A 202		24	4	2	0	0	0	0
33	A 202 II		12	57	0	0	0	0	0
34	A 203		12	51	0	0	0	0	0
35	A 209		6	0	0	0	0	0	0
36	A 210		6	0	0	0	0	0	0
37	A 211		6	0	0	0	0	0	0
38	A 212		6	0	0	0	0	0	0
39	A 213		6	0	0	0	0	0	0
40		Male wash room		0	0	0	0	0	0
41	A 301		1	0	0	0	0	0	0
42	A 302		6	0	0	0	0	0	0
43	A 303		6	0	0	0	0	0	0
44	A 305		12	54	0	0	0	0	0

Sr. no	Location	Name	Fan	PC	Printer	Photo Copy. machine	AC	Wall fan	Trade mill
45	A 306-307		12	0	0	0	0	0	0
46	A 308-309		12	54	0	0	2	0	0
47	A 310		0	4	1	0	1	0	0
48	A 312		6	0	0	0	0	0	0
49	A 313		6	0	0	0	0	0	0
50	A 314		6	0	0	0	0	0	0
51	A 315		6	0	0	0	0	0	0
52	A 316		6	0	0	0	0	0	0
53	A 317		6	0	0	0	0	0	0
54	A 318		6	0	0	0	0	0	0
55	A 319		6	0	0	0	0	0	0
56	Washroom		0	0	0	0	0	0	0
57	A 401		0	0	0	0	0	0	0
58	A 402		6	0	0	0	0	0	0
59	A 403		18	0	0	0	0	0	0
60	A 404		6	0	0	0	0	0	0
61	A 405		6	0	0	0	0	0	0
62	A406-407		10	0	0	0	0	0	0
63	A 408-409		12	0	0	0	0	0	0
64	A 410		6	0	0	0	0	0	0
65	A 411-412		12	0	0	0	0	0	0
66	A 413		6	0	0	0	0	0	0
67	A 414		6	0	0	0	0	0	0

Sr. no	Location	Name	Fan	PC	Printer	Photo Copy. machine	AC	Wall fan	Trade mill
68	A 415-416		12	60	0	0	0	0	0
69		Dept. of EC	10	2	0	0	1	0	0
70	B block	Material testing lab	6	0	0	0	0	0	0
71	B03	Geo technical lab	6	0	0	0	0	0	0
72	B04	Transformation Engg Lab	6	0	0	0	0	0	0
73	B 05	Project lab	6	0	0	0	0	0	0
74	B 06	Electrical machine lab	12	0	0	0	0	0	0
75	B 07	Store	12	0	0	0	0	0	0
76	B 08		5	0	0	0	0	0	0
77	B 09	Conference hall	0	0	0	0	0	0	0
78	B 10		6	0	0	0	0	0	0
79	B 11	Registrar office	11	10	4	0	0	0	0
80	B 12		0	0	0	0	0	0	0
81	B 13		0	0	0	0	0	0	0
82		Corridor	0	0	0	0	0	0	0
83	B 101	Wash room	0	0	0	0	0	0	0
84	B 102	Civil Engg. Lab	6	0	0	0	0	0	0
85	B 103	Engg. Geology lab	6	0	0	0	0	0	0
86	B 104	B.M.E Lab	6	0	0	0	0	0	0
87	B 105	Class room	6	0	0	0	0	0	0
88	B 106	Class room	6	0	0	0	0	0	0
89	B 107	Class room	6	0	0	0	0	0	0

Sr. no	Location	Name	Fan	PC	Printer	Photo Copy. machine	AC	Wall fan	Trade mill
90	B 108	Class room	6	0	0	0	0	0	0
91	B 109	Store room	6	0	0	0	0	0	0
92	B 110	Dept. of Civil Engg. Office	10	1	0	0	1	0	0
93	B 111	Civil Library	6	0	0	0	0	0	0
94	B 112	Class room	6	0	0	0	0	0	0
95	B 113	Class room	6	0	0	0	0	0	0
96	B 114	Class room	6	0	0	0	0	0	0
97	B 115	Wash room		0	0	0	0	0	0
98	B 116	staff wash room		0	0	0	0	0	0
99	B 201	Wash room		0	0	0	0	0	0
100	B 202	CAD Lab	6	0	0	0	0	0	0
101	B 203	Class room	6	0	0	0	0	0	0
102	B 204	Class room	6	0	0	0	0	0	0
103	B 205	Class room	6	0	0	0	0	0	0
104	B 206	tutorial room	6	0	0	0	0	0	0
105	B 207	Class room	6	0	0	0	0	0	0
106	B 208	NCC Office	6	0	0	0	0	0	0
107	B 209	Yoga meditation	6	0	0	0	0	0	0
108	B 210	Dept of Elec. & Electronic Hod	10	1	0	0	0	0	0
109	B 211	Control System lab	12	0	0	0	0	0	0
110	B 212		12	0	0	0	0	0	0
111	B 213	Wash room	0	0	0	0	0	0	0

Sr. no	Location	Name	Fan	PC	Printer	Photo Copy. machine	AC	Wall fan	Trade mill
112	B 214	Wash room (male)	0	0	0	0	0	0	0
113		Corridor	0	0	0	0	0	0	0
114	B 301	Wash room Boys	0	0	0	0	0	0	0
115	B 302	tutorial room	6	0	0	0	0	0	0
116	B 303	tutorial room	6	0	0	0	0	0	0
117	B 304	PG research Lab	Lock	0	0	0	0	0	0
118	B 305	Software Engg	12	30	0	0	0	0	0
119	B 306	tutorial room	6	0	0	0	0	0	0
120	B 307	Class room	6	0	0	0	0	0	0
121	B 308	Computer Networking lab	12	60	0	0	0	0	0
122	B 309	T & P Cell	10	1	1		1	0	0
123	B 310	T&P Hall	16	0	0	0	0	0	0
124	B 311	Seminar hall	16	0	0	0	0	0	0
125	B 312	Wash Room Boys	0	0	0	0	0	0	0
126	B 313	Wash room girls	0	0	0	0	0	0	0
127	B 401	Wash Room Boys	0	0	0	0	0	0	0
128	B 402	Class room	12	0	0	0	0	0	0
129	B 403	Class room	12	0	0	0	0	0	0
130	B 404	EDC Project Lab	12	0	0	0	0	0	0
131	B 405	tutorial room	6	0	0	0	0	0	0
132	B 406		6	0	0	0	0	0	0
133	B 407		10	3	0	0	0	0	0

Sr. no	Location	Name	Fan	PC	Printer	Photo Copy. machine	AC	Wall fan	Trade mill
134	B 408	Class room	12	0	0	0	0	0	0
135	B 409	T&P Hall	12	0	0	0	0	0	0
136	B 410	Wash room	0	0	0	0	0	0	0
137	B 411	Wash room	0	0	0	0	0	0	0
138	C 102	Conference hall	6	0	0	0	2	0	0
139	C 103	Conference hall	6	0	0	0	2	0	0
140	C 101	Guest room	2	0	0	0	1	0	0
141	C 301		3	0	0	0	0	0	0
142	C 302		12	0	0	0	0	0	0
143		Seminar hall T&P	12	0	0	0	0	0	0
144		PPT Hall	38	0	0	0	5	0	0
145	Boys Hostel		45	0	0	0	2	0	0
146	GYM		0	0	0	0	0	0	2
147		Campus Street Light	0	0	0	0	0	0	0
	Total		**1013**	**431**	**13**	**2**	**22**	**1**	**2**

4.2 Photographs of lighting system



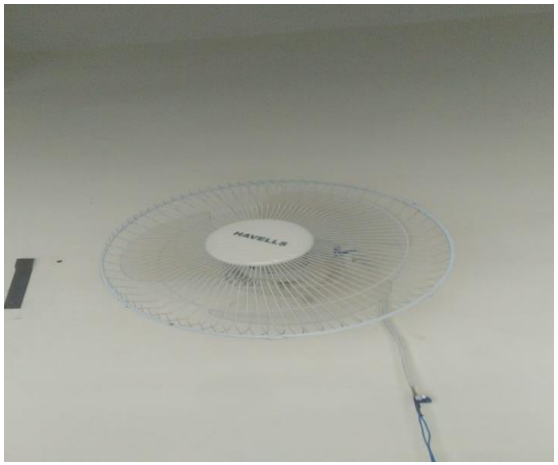


Table 4.4: Details air-conditioning load (window and split AC)

Sr. no	Block	Location	AC	Make	Cooling capacity (Ton)	Type	Rating Star	Year
1	-	Director room	1	Voltas	2	Split	3	2013
2	-	Executive director office	2	Voltas	2	Split	3	2013
3	Ground floor	Conference hall	1	Blue star	2	Split	3	2024
4	A 201	-	1	Camipro	1.5	Split	2	2020
5	A 308-309	-	2	LG	1.5	Split	2	2010
6	A 310	-	1	Videocon	1.5	Window	NA	2010
7		Dept. of EC	1	Blue star	1.5	Split	3	2011
8	B 110	Dept. of Civil Engg. Office	1	Blue star	1.5	Split	3	2011
9	C 102	Conference hall	2	Blue star	2	Split	3	2023
10	B 305	DBMS Skill dept.	1	LG	1.5	Split	3	2020
11	C 103	Conference hall	2	Blue star	2	Split	3	2023
12	C 101	Guest room	1	Blue star	2	Split	3	2023
13	-	PPT Hall	5	Blue star	4.5	Cassette	1	2016
14	Boys Hostel	Guest house	2	Blue star	2	Split	3	2023
	Total		**23**					

Observation: It was observed that most of the ACs is star rated. It is appreciable. There is a good potential to install microprocessor based energy saving control system on the above ACs. The detailed energy saving calculations is given in chapter 5.

4.3 Photographs of ACs and fan



CHAPTER-5
ENERGY CONSERVATION MEASURES

This chapter describes the energy conservation measures that can be implemented in a phase manner to optimize energy consumption in the building

ECM: 5.1 Replacement of Conventional FTL (T-8) 36W by LED (T-5) 20W

Sr. No	Items	Parameters	Units
1	Power Consumption by Conventional Tube Light FTL (T-8) 36W	50	Watt
2	No of FTL (T-8)	738	Nos.
3	Working Hours per Day	8	Hrs./Day
4	Working Days per Year	250	Days/Year
5	Rated Power of Energy Efficient LED (T-5)	20	W
6	Energy Saving Potential	44280	kWh/Year
7	Load Factor	80	%
8	Expected Annual Energy Saving	35424	kWh/Year
9	Overall Per Unit Charges for calculation	8.50	Rs./kWh
10	Expected Annual Monetary Saving	3,01,104/-	Rs./Year
11	Cost of LED (T-5)	200/-	Rs./ Piece
12	Investment on New LED Lighting Purchase	1,47,600/-	Rs.
13	Simple Pay Back Period	0.5	Year

ECM: 5.2 Replacement of 4x4 sq fitting (18W*4) by LED sq. fitting

Sr. No	Items	Parameters	Units
1	Power Consumption by 4x4 sq fitting (PL-4) (18W*4)	72	Watt
2	No of 4x4 fixtures	270	Nos.
3	Working Hrs./Day	8	Hrs./Day
4	Working Days/Year	250	Days/Year
5	Rated Power of Energy Efficient 1x1 sq fitting (LED)	36	W
6	Energy Saving Potential	19440	kWh/Year
7	Load Factor	80	%
8	Expected Annual Energy Saving	15552	kWh/Year
9	Overall, Per Unit Charges	8.50	Rs./kWh
10	Expected Money Saving	1,32,192/-	Rs./Year
11	Cost of 1x1 sq. fitting	1000	Rs./ Pices
12	Investment on New Light Purchasing	2,70,000/-	Rs.
13	Simple Pay Back Period	2.0	Year

ECM: 5.3 Replacement of 30W CFL by 15W LED

Sr. No	Items	Parameters	Units
1	Total Power Consumption by CFL	30	Watt
2	No of CFL	25	Nos.
3	Working Hrs./Day	8	Hrs./Day
4	Working Days/Year	250	Days/Year
5	Rated Power of Energy Efficient LED	15	W
6	Energy Saving Potential	750	kWh/Year
7	Load Factor	100	%
8	Expected Annual Energy Saving	750	kWh/Year
9	Overall, Per Unit Charges	8.50	Rs./kWh
10	Expected Money Saving	6,375/-	Rs./Year
11	Cost of LED	200/-	Rs./ Pices
12	Investment on New Light Purchasing	5,000/-	Rs.
15	Simple Pay Back Period	1	Year

ECM: 5.4 Replacement of 200W CFL by 100W LED

Sr. No	Items	Parameters	Units
1	Total Power Consumption by CFL Gym	200	Watt
2	No of CFL	9	Nos.
3	Working Hrs./Day	8	Hrs./Day
4	Working Days/Year	250	Days/Year
5	Rated Power of Energy Efficient LED	100	W
6	Energy Saving Potential	1800	kWh/Year
7	Load Factor	100	%
8	Expected Annual Energy Saving	1800	kWh/Year
9	Overall, Per Unit Charges	8.50	Rs./kWh
10	Expected Money Saving	15,300/-	Rs./Year
11	Cost of LED	1500	Rs./ Pices
12	Investment on New Light Purchasing	13,500	Rs.
13	Simple Pay Back Period	1	Year

ECM: 5.5 Replacement of 18W CFL by 9W LED Down lighter

Sr. No	Items	Parameters	Units
1	Total Power Consumption by CFL	18	Watt
2	No of CFL	26	Nos.
3	Working Hrs./Day	8	Hrs./Day
4	Working Days/Year	250	Days/Year
5	Rated Power of Energy Efficient 1x1 sq fitting (LED)	9	W
6	Energy Saving Potential	468	kWh/Year
7	Load Factor	100	%
8	Expected Annual Energy Saving	468	kWh/Year
9	Overall, Per Unit Charges	8.50	Rs./kWh
10	Expected Money Saving	3,978/-	Rs./Year
11	Cost of 1x1 sq. fitting	100/-	Rs./ Pices
12	Investment on New Light Purchasing	2600/-	Rs.
13	Simple Pay Back Period	0.7	Year

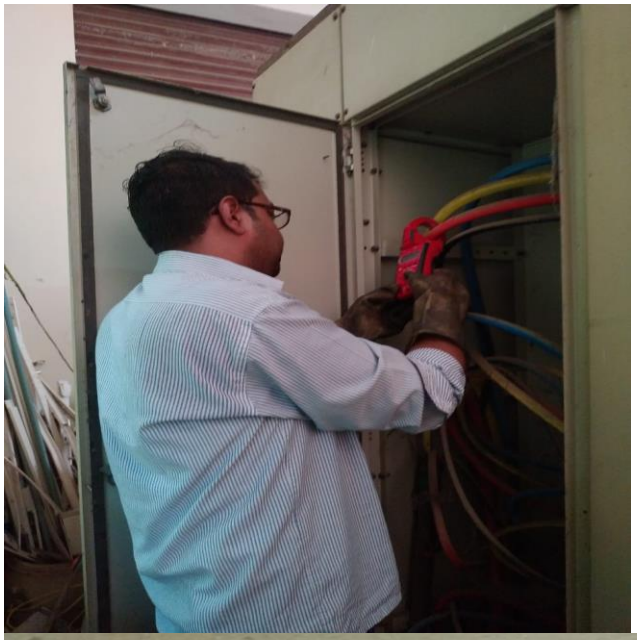
ECM: 5.6 Replacement conventional Ceiling fans 60W by BLDC fan 28W

Sr. No	Items	Parameters	Units
1	Conventional ceiling fan in the institute	50	Watt
2	No of fans	1013	Nos.
3	Working Hrs./Day	10	Hrs./Day
4	Working Days/Year	250	Days/Year
5	Rated Power consumption of BLDC fan	28	W
6	Energy Saving Potential	55715	kWh/Year
7	Load Factor	100	%
8	Expected Annual Energy Saving	55715	kWh/Year
9	Overall, Per Unit Charges	8.50	Rs./kWh
10	Expected Money Saving	4,73,577/-	Rs./Year
11	Cost of BLDC Fan sq. fitting	2800/-	Rs./ Pices
12	Investment on New Light Purchasing	28,36,400/-	Rs.
13	Simple Pay Back Period	6.0	Year

ECM: 5.7 Installation of Airtron 'intelligent' microprocessor energy saver

Sr. No	Items	Parameters	Units
1	Average power consumption of 1.5 ton AC	1750	Watt
2	No of AC	22	Nos.
3	Working Hrs./Day	8	Hrs./Day
4	Working Days/Year	200	Days/Year
5	Expected saving @ 30% of power consumption of AC	525	W
8	Expected Annual Energy Saving	18,480	kWh/Year
9	Overall, Per Unit Charges	8.50	Rs./kWh
10	Expected Money Saving	1,57,080/-	Rs./Year
11	Cost of Airtron 'intelligent' microprocessor energy saver	7,500	Rs./ Pices
12	Total Investment on energy saver	1,65,000/-	Rs.
13	Simple Pay Back Period	1.1	Year

ANNEXURE-I: Onsite power measurement



Annexure-II: BLDC ceiling fan product catalog

Sweep (mm)	Power (W)	Input Voltage (V)	RPM	Air Delivery CMM (m^3/min)	Power Factor	Service Value (CMM/W)	MRP (₹)
900	28	140-285	470	157	0.99	5.6	3590
1050	32	140-285	430	235	0.99	7.4	3690
1200	28	140-285	340	235	0.99	8.4	3690
1400	32	140-285	275	270	0.99	8.4	4090

Annexure-III: Airtron intelligent microprocessor energy saver product catalog